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A GUIDE TO THE POISONOUS PLANTS AND
WEED SEEDS OF CANADA AND THE
NORTHERN UNITED STATES

A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States

By

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PREFACE

The primary reason for this publication is the long-felt need of a text-book to accompany the course on poisonous plants which is given the students of the Ontario Veterinary College. This object has been kept constantly in mind. It has necessitated the preparation of a book at a price within the reach of every student, and yet one that contains in easily available form an up-to-date knowledge of our common poisonous plants, the characteristics by which they may be recognized, the symptoms produced by them and the remedial treatment required. It is hoped that the book will also prove useful to the veterinarian who is in practice, the farmer, the stockman and, to a more limited extent, the medical practitioner and the public generally.

In arranging the work, a departure has been made from the usual practice. To facilitate the determination of the plant responsible in a given case of poisoning, the book has been divided into four sections. In the first three are included the plants that are mainly responsible for fatalities among animals. These are grouped on the basis of their source in the animal's feed, whether found in hay (Section I), in pasture (Section II), or in concentrated feedstuffs (Section III). A word may be added regarding Section III, since so far as the authors are aware this is the first time that the importance of poisonous plant constituents in concentrated feedstuffs has been given recognition in a text-book. Micro-analytical methods have lately been extended to determine the presence in such feedstuffs of poisonous material that eludes the ordinary

chemical analysis. As a result, it has been found that poisonous seeds in injurious quantities have been included with great frequency in our commercial feeds, giving rise to fatalities and disease, the cause of which was hitherto unsuspected. The loss in Canada has been so great that, after thorough investigation, the Department of Agriculture has designed a new feedstuffs act with a view to its prevention, and established a micro-analytical laboratory for the enforcement of the statute. In the fourth Section are grouped the plants that, although poisonous, rarely cause the death of animals. It comprises by far the largest number, including some that are the source of medicinal drugs, others that have large amounts of virulent poison, and many that are poisonous only if taken in quantity—all not sufficiently attractive to animals to be the source of much danger. Previously considerable confusion resulted from bulking, without discrimination, all the plants that contain poison. It is hoped that the arrangement followed in this book will be found of practical value, by avoiding this difficulty and rendering the determination of the plant easier. The medical profession should find Section IV of most interest since the plants that are mainly responsible for poisoning in man are collected here. (See p. 109.)

The illustrations are from photographs and drawings made especially for the book. By means of these and by the classification into the groups above referred to, it should be possible for an amateur to identify the plant responsible in an ordinary case of poisoning. No key based on botanical characters has been included, since such a key would be impracticable because of confusion with the numerous non-poisonous forms. At the end of the book, however, a "symptoms" key has been added. Such a key cannot, in the present state of our knowledge, be made precise. Its purpose is merely to facili-

tate diagnosis by suggesting the plants that should be looked for when certain symptoms are observed and plant poisoning is suspected.

A word may not be inopportune on the need of research on poisonous plants. The indefiniteness with which many statements have had to be made and the dearth of positive experimental work upon which to base conclusions have been keenly felt in the preparation of these pages. Two lines of attack are evident, one based on the detailed chemical analysis of the poisonous plant, the other on feeding experiments with the plants themselves. These two lines are complementary and both very necessary. The toxic substance having been determined, it is often at once evident what the chemical antidote should be. Moreover, much is known or could be easily learned of the conditions of its action. For example, how much is immediately apparent when it is known that prussic acid is the chemical responsible for Cherry or Sorghum poisoning. Knowing the volatile character of this toxic substance we can at once see why the dried fodder is harmless. Again, when the chemical responsible for Hemlock poisoning was found to be polymerized by heat much of the erratic character of the poisoning in this case was understood. It was quite evident why this plant was less dangerous in the heat of summer. Still all the emphasis must not be placed on this line of research, essential though chemical analysis assuredly is. The constitution of a plant is exceedingly complex and several factors may co-operate in producing the poisonous effects. As mechanical injury in the case of Skunk-tail Grass opens the way for bacterial infection, so in the case of Horsetail poisoning, it is quite possible that irritation of the digestive tract by the indigestible silica may pave the way for the attack of a chemically poisonous substance. It is thus only by feeding experiments, ap-

proaching the natural conditions as nearly as possible, that final and dependable results can be obtained. A creditable beginning has been made both in the United States and in Canada. Such work along physiological lines should be continued as well as research on the poisonous plants from the chemical standpoint. This is the immediate need. After proper antidotes and treatment have been discovered, however, there still remain two problems—one in connection with the utilization of the highly complex organic products that some of these weeds* contain, products that are very difficult to form synthetically in our chemical laboratories; and the other concerned with the elimination of the weeds themselves from our grain fields, pastures, parks and ranges. The importance of such work to the community at large warrants a comprehensive plan of attack and ample government support.

No bibliography has been compiled. This service has been admirably performed in Pammel's "Manual of Poisonous Plants," and Long's "Plants Poisonous to Livestock," which should be consulted by everyone wishing to make a more special study of the subject. References to these books and the many publications of the various agricultural departments and colleges will be made throughout the work.

The authors wish to express their indebtedness to Professor N. C. Hart, of Western University, and Miss M. V. McCulloch, of the Botany Department, University of Toronto, for contributions to the illustrations, and to Miss Jane McGillicuddy for help in the preparation of the

*An industrial use has already been found for Wild Mustard, *Brassica arvensis*, the seed of which is being separated from grain screenings by special machinery and utilized on a commercial scale, at the same time improving the screenings for feeding purposes.

· text. Dr. C. D. McGilvray, Principal of the Ontario Veterinary College, kindly consented to read the original manuscript, and his suggestive criticisms have been much appreciated.

R. B. THOMSON.

H. B. SIFTON.

University of Toronto,
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SECTION I

Plants Dangerous When Included in Hay and Coarse Feeds.

Certain animals are poisoned by hay, straw, ensilage, etc., when they could have pastured with impunity on the fields where the feed was raised. There are several reasons why this is so. In the first place, animals in pasture have a better chance to pick their food. The plants grow up separately and distinct from each other, and there is usually enough wholesome feed to allow of a choice. It thus often happens that a weed, refused by an animal in pasture, may be eaten when cured and mixed with the hay. This is especially so where the amount or concentration of the ration is insufficient. Again, certain weeds which are eaten with impunity in pasture may cause trouble when eaten by an animal confined to a non-succulent ration. The laxative nature of the green grass and the freedom of exercise give the animal in pasture or on the range a much better chance to overcome the effects of toxic substances. It may also be pointed out that moulds and bacteria grow on forage under conditions that would rarely if ever obtain in the field.

FUNGI AND BACTERIA.

ERGOT—*Claviceps purpurea* (Fr.) Tul.

The drug Ergot is believed to have been used by the ancient Jews before the dispersal of their nation. It was certainly used in medicine long before the details of its growth were discovered. While it has for years been known to be a fungous disease, there are still people who are ignorant of the fact and believe that the "ergots"* that grow on their grains or grasses are merely degenerate kernels. Its history as a poison is also very old. Epidemics of ergotism were recorded in the time of Julius Caesar, and since then the plague has recurred again and again, usually following rainy seasons. In America it has caused great losses. It is most dangerous in hay, but gives trouble also in ground feeds.

Repeated small doses such as an animal may obtain by eating infected hay or grain have a cumulative effect, causing chronic ergotism. This disease is due to the action of the drug on the nervous system, and may become evident in either of two forms, depending on whether the sympathetic or central nervous system of the animal proves more susceptible.

In the *gangrenous type*, which is the more common, the sympathetic nerves are affected. The arterioles, which connect the arteries and capillaries of the body, are controlled by sympathetic nerves. Ergot, by stimulating these, causes a contraction of the arteriole walls and produces two secondary effects. Since the blood can with difficulty be forced through into the capillaries there is much increased blood pressure in the heart and arteries, and more important than this, the tissues, especially

*The word ergot is from the old French *argot*—a cock's spur.

those of the extremities, cannot obtain a sufficient supply of blood. This shows itself first in coldness, paleness and loss of feeling in the extremities. Later the tissues die, producing the condition known as gangrene. The ears, hoofs and tail often slough off, and gangrenous sores may form on other parts of the body. Gangrene may set in very quickly if the quantity of ergot eaten is sufficient. An extreme case has been recorded of a horse that was given a feed of badly ergotized hay. At the end of the first day the left hind leg was cold, stiff and moist with sweat. In two days gangrene had commenced, and in three the animal died—the skin and some of the muscles of the affected leg having already sloughed off.

The second, or *spasmodic* type of the disease is described as follows by Pammel: "Tonic contractions of the flexor tendons of all the limbs, anaesthesia of the extremities, muscular trembling, general tetanic spasms, convulsions and delirium." In other cases Long states that fatigue and cold sweat are followed by paralysis of the tongue and muscles used in swallowing and later by general paralysis. In both types of the disease the heart's action is very slow, probably due to the stimulation of the vagus nerve.

Very large quantities of ergot produce acute ergotism. Dr. Winslow has investigated the symptoms in dogs, and states them as follows: "Vomiting, profuse salivation, dilation of the pupils, rapid breathing and frequent pulse. The animal cries out, has convulsive twitchings, staggering gait, paraplegia, intense thirst and coma, terminating in death."

In addition ergot must be held responsible for many cases of sporadic abortion, although this effect does not follow in the earlier stages of pregnancy as often as is

supposed. The action of the drug in contracting the walls of the uterus is well known to physicians, however, and is made use of in obstetrical work.

In cases of poisoning, tannic acid should be administered to neutralize any ergot remaining in the alimentary tract. For what has been absorbed
Treatment chloral hydrate and nitrous ether are the best physiological antidotes. Warm antiseptic dressings should be applied to parts threatened with gangrene. Sometimes amputation of gangrenous ears or tail is necessary.

The plant is a parasitic fungus belonging to the Ascomycetes or sac-fungi, so-called, because they bear their spores in asci or sacs. Its threadlike hyphae
The Ergot Fungus feed on and replace the cells in the seed of the affected plant, forming a hard, compact mass known as the sclerotium, black on the surface and white or slightly purplish within. The hardness and light colour of the interior of the ergotized grain render it easily distinguishable from grains infected by smut or bunt, which have a dark granular appearance. The sclerotium is considerably longer than the uninfected grain, cylindrical or slightly angular, with pointed ends. The mass of hyphae composing it is concealed by globules of fat which must be dissolved out if the microscopic structure is to become evident.

This sclerotium is the wintering stage of the *Claviceps*. In the spring it does not grow into a young plant like the unaffected grain, since the germ has been destroyed by the fungus, but if it secures lodgment in a damp place, produces here and there small raised spots which develop into minute globular bodies with stalks. The round heads change from white to a pinkish colour as

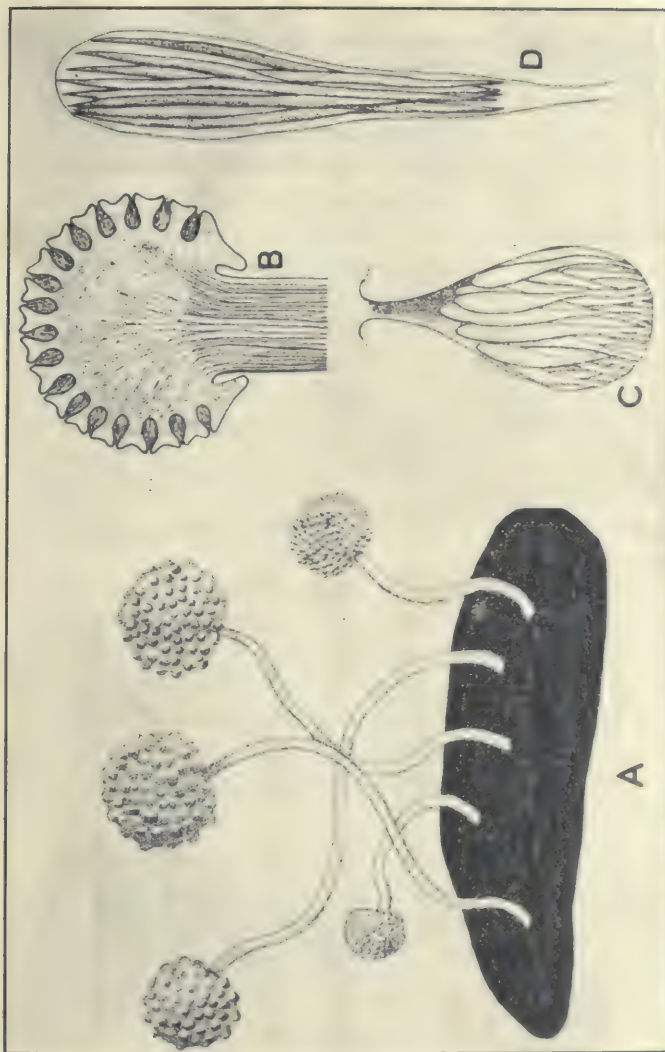


Fig. 1.—Formation of ascospores in Ergot—*Claviceps purpurea*. Figures highly magnified.

a Sclerotium bearing fruiting heads (stromata).

b Section through fruiting head, showing flask-shaped perithecia.

c Single perithecial head showing asci.

d Ascus with eight ascospores.

they ripen. Examined microscopically they are seen to be covered with pores each leading to a flask-shaped cavity in the body of the head. These cavities contain a number of asci. In each ascus are eight threadlike spores, the ascospores. These are discharged at the time when the host plant is in flower. Falling on the young ovary of the flower, the spore germinates producing fungous filaments (hyphae) which enter, feed upon, and displace the soft tissues, ultimately forming another sclerotium. Before hardening, however, the fungus passes through the *Sphacelia* stage, in which a sweetish liquid called honey-dew is secreted, and numerous small spores known as conidia are formed and cut off from the free ends of the hyphae. These are carried to other plants by insects attracted by the fluid, and so the Ergot is spread throughout the field, since each spore which reaches another young ovary may germinate and infect that grain.

Rye is more often attacked than other cereals, and it is from this plant that the ergot used in medicine is obtained. Wheat is sometimes ergotized, however, and oats containing the fungus have been reported. In addition, this fungus, or possibly a closely related species having the same effects, is found on a large number of grasses of wide geographical distribution. The following are species affected:

<i>Agropyron Smithii</i> Rydb.	Western Wheat Grass
<i>Agropyron repens</i> (L.) Beauv.	Couch Grass
<i>Hystrix Hystrix</i> Millsp.	Bottlebrush Grass
<i>Elymus canadensis</i> L.	} Wild Rye
“ <i>robustus</i> Scribn. & J. G. Sm.	
“ <i>striatus</i> Willd.	
“ <i>virginicus</i> L.	



Fig. 2.—Heads of some grasses infected with Ergot—*Claviceps purpurea*:

a Blue-joint Grass—*Calamagrostis canadensis*.

b Timothy—*Phleum pratense*.

c Western Wheat Grass—*Agropyron Smithii*.

d Awned Wheat Grass—*Agropyron Richardsoni*.

e Rye—*Secale cereale*.

f Wild Rye—*Elymus diversiglumis*.

<i>Phleum pratense</i> L.	Timothy
<i>Poa pratensis</i> L.	Kentucky Blue Grass
<i>Poa annua</i> L.	Low Spear Grass
<i>Calamagrostis canadensis</i> (Michx.) Beauv.	Blue-joint Grass
<i>Agrostis alba</i> L.	Red Top
<i>Glyceria fluitans</i> (L.) R. Br.	Floating Manna Grass.

Meadows infested with Ergot should not be cut for hay or pastured after sclerotia have formed. By cutting early, while the grass is in flower, the spread of the disease can be checked. Wholesome hay will also be obtained by this procedure.

FORAGE POISONING.

There have been very severe losses from forage poisoning in various parts of this continent, but although much painstaking work has been done to determine the cause of the disease, the results have been conflicting and unsatisfactory. Horses and mules are the animals chiefly attacked, the disease following the feeding of mouldy silage, spoiled hay, or immature mouldy corn. Cattle, sheep, pigs and poultry are apparently very resistant if not immune.

Many have considered that the disease is due to poisons secreted by moulds on the feed. Several species of mould grow commonly on corn and hay and a great deal of work has been done with a view to determining the particular one responsible. Efforts toward this end have not been successful. From experience with numerous cases of poisoning, evidence against a certain mould or group of moulds has been built up. Later,

samples have been found which, though they contained these moulds, were harmless. Such differential action might possibly be accounted for by assuming the presence of different strains of the same species. An analogous case has been described by Dr. M. Otto, who found that while a strain of *Aspergillus fumigatus* from Italy was markedly poisonous, another from Germany was not at all, or only slightly so. The existence of similar strains of other common moulds has not, however, been demonstrated.

A more promising line of attack has been from the bacteriological standpoint. The work was carried out at the Kentucky Agricultural Experimental Station by Graham, Bruechner and Pontius. They isolated from mouldy hay that had caused typical cases of forage poisoning, a bacillus resembling *B. botulinus*, the organism of botulism. Like the latter it is an anaërobic bacillus but grows in air when accompanied by certain of the moulds usually found on forage. Pure cultures of the bacillus, fed to horses, mules and guinea pigs, produced typical cases of forage poisoning, similar to those caused by the hay from which it had been obtained. The disease is apparently caused by toxins produced for the most part, before the forage is eaten. In their experiments animals were poisoned from a single barrel of the hay, by water which had been poured over the forage and had dissolved some of the toxin. Since the bacillus in question closely resembled *B. botulinus* in appearance, anaërobic characters, and physiological effects, these investigators made further tests to determine, if possible, whether the two were identical. Antitoxic serum prepared from *B. botulinus* was procured and was found to produce immunity from the effects of the bacillus cultured from the poisonous

hay. It was further found that the hay itself, or rather the water in which it had been steeped, was incapable of producing forage poisoning in animals protected by the *B. botulinus* antitoxic serum. Samples of food which had produced forage poisoning in two other widely separated parts of the country were found to contain the same bacillus. It has thus been proved that one cause of forage poisoning is a bacillus, and that this bacillus, if not *B. botulinus*, resembles it so closely that morphological investigation has thus far disclosed no differential characteristics. Although the investigators hardly feel yet in a position to state that it is the only cause, the results are most promising and would appear to indicate the final solution of this perplexing problem.

The first symptom noticed is usually weakness and staggering, with a tendency to stumble over ordinary low objects. The muscles of the tongue and throat
Symptoms become paralysed, and saliva drips from the mouth owing to difficulty in swallowing. The animal may become violent, rushing about, usually in a circle, and crashing into objects that come in his way. He soon becomes stupid and sleepy, and gradually loses control of his muscles, leaning against the stall or standing with feet spread apart. Paralysis increases, and after some time he is unable to stand. Bladder and bowels become partly paralysed and do not function unless artificially stimulated. The animal may live from one to two weeks, but in some cases death may take place within a day or so from the time symptoms become noticeable. Dr. McGilvray even states that animals may drop dead when taken from the harness, without showing any previous symptoms.

If treatment is begun soon enough, some of the animals may be saved. It is important to remove all traces of the poison as quickly as possible from the

Treatment alimentary canal and to prevent access to mouldy or spoiled feed of any kind. It is necessary also to discontinue immediately the feed-stuffs in use and provide an entire change of feed, to avoid a further ingestion of poisonous substance. A purge and nerve stimulants as well as atropin for the circulation are recommended. Haslam prescribes injections of arecolin or eserine and pilocarpin followed by an antiferment and possibly an aloes bolus. Where paralysis of the throat has begun medicine cannot be given by mouth except by means of the stomach tube, as it is almost sure to enter the air passages and cause suffocation.

HORSETAIL FAMILY—*Equisetaceae*.

THE HORSETAILS—*Equisetum* spp.

In ancient times the Horsetail family was one of the most important. The fossil record shows that its members formed a striking part of the coal forest swamps, their jointed stems, two feet or more in thickness, rising to heights of fifty to one hundred feet. To-day there are only a few isolated species of a single genus, composed of small plants ranging from a few inches to a few feet in height. Unable to keep pace with changing conditions the race has been falling behind for millions of years.

Animals of the coal forests may have found the Horsetails edible, but in their present form some at least are quite injurious. With regard to the nature

Examples and Conditions of Poisoning of the poison, there is some diversity of opinion, although the old idea of the mechanical action of silica, a common and sometimes prominent constituent of the Horsetails, has been

practically abandoned, in favour of a chemical basis. Aconitic acid was first found and suspected. Later work disclosed an alkaloidal nerve poison, called equisetin, which was proved to be present in one species at least, in sufficient quantity to be dangerous to animals. Whatever the nature of the poison, numerous instances of its harmful effect have been recorded. It is especially injurious to horses. In one much quoted case, nine horses, fed on good hay, were bedded with swale hay containing the Horsetail. They acquired the habit of eating their bedding and as a result all soon showed symptoms of Equisetosis. The youngest, three years old, became unable to stand, and died in a few days. Others, somewhat older, became very ill, keeping on their feet with difficulty, but finally recovered. One mare, much older than the rest, showed only slight symptoms. Five other horses on the same farm, fed in the same way, but bedded with straw, remained in perfect health.

In this country the Field Horsetail, *Equisetum arvense* L., causes most trouble because it is often found in hay, especially from low lying fields. Animals may graze in pastures containing Horsetail without harm, either because of the laxative effect of the green forage or because they can pick their food better than when fed in the stall. Grain-fed work horses seem little liable to attack, while colts or young animals are chiefly affected. Cattle eat the Field Horsetail without apparent harm, although other species in Europe are said to be poisonous to them. The effect of Horsetail on sheep is doubtful.

A noteworthy indication of incipient Horsetail poisoning is the development of a depraved appetite, the animal often eating its bedding with Horsetail in it
Symptoms in preference to good hay or even grain. After the disease develops the symptoms are quite as marked.

Diarrhœa and rapid loss of flesh are first observed, followed by muscular incoördination. The animal sways and staggers, finally becoming unable to stand. The temperature is at first sub-normal, but after the animal falls its struggles produce a fever. The appetite usually remains good throughout, but weakness increases and death may follow from exhaustion due to the continued struggles to rise. The circulation is poor, as shown by coldness of the extremities and paleness of the delicate membranes of the mouth, nostrils and eyes. The disease can be distinguished from bracken poisoning which it somewhat resembles, by the constipation and redness of the eyes that accompany the latter. (See p. 33.)

The treatment is as follows. Remove all hay containing Horsetail and administer a purge. Rich and Jones recommend a pill of one ounce Barbados
Treatment aloes, one or two drachms of ginger and enough soft soap to bind the powder together. If these are not available, a quart of linseed oil may be used as a substitute. A teaspoonful of nux vomica added to the grain ration three times daily helps to relieve the muscular trouble. It is important to avoid exciting the animal, and to keep him on his feet. If he seems likely to fall he should be supported in slings—arranged to press very lightly on the abdomen when he is standing but to give support as soon as the least bending of the legs takes place.

The Field Horsetail thrives best in fairly light sandy soil, wet, or at least moist for a considerable part of the season. Other species live partially submerged
The Plant in ponds or streams. There is a perennial rootstock—a horizontal stem running beneath the surface of the ground. This rootstock is jointed and branched, the



Fig. 3.—Field Horsetail—*Equisetum arvense*.

- a* Ordinary, green, summer form, with whorls of simple branches.
- b* Brown, spring form, bearing cones and attached to an underground stem, with a food-tubercle.
- c* A branch of the "bushy" type, with many secondary branches.
- d* Branch segments, with pointed teeth (leaves) at the tip, and narrowed base. *a*, *b* and *c* about half, and *d* about twice natural size.

branching providing an excellent means for the spread of the plant. The ordinary aerial stems are branched or simple, according to the species, and may be easily pulled apart at the joints, which are sheathed by the united bases of small pointed leaves. Stems and branches are characteristically ridged and furrowed, this and the ease with which the plant breaks at the joints, affording a definite means of identification. The Horsetails contain a large proportion of silica, which makes them harsh and rough to the touch. This has given rise to the popular name, Scouring-rush, for the Winter Horsetail, whose stout unbranched stem is sufficiently hard to scratch glass. The branched forms contain less silica, but still sufficient, it was formerly held, to account for Horsetail poisoning. Food manufacture is carried on by the green stems and branches, the scale-like leaves being useless in this connection. The spores are contained in cone-shaped structures at the tips of stems. In *Equisetum arvense* L. the stem that bears spores is brown and succulent and takes no part in food production. It grows and matures in early spring, living on food stored in the underground parts during the previous year. In other species the spores are borne on the ordinary green plant. The cone is composed of a number of peltate or umbrella-shaped hexagonal structures borne on short stalks. These are the sporangiophores, each of which bears a number of sporangia or spore-sacs, suspended from its under surface. The outer coat of the green spores contained in them is split into four ribbons which expand and contract with the moisture changes of the air and give to the spore mass an appearance of writhing life.

Four species have been experimented with and found to be harmful. One of these, *Equisetum hyemale* L., the

Harmful Species	Scouring-rush or Winter Horsetail, can be distinguished from the other three by the fact that it has an evergreen stem. This is usually unbranched and of considerable size, sometimes half an inch or more in diameter and several feet high. The other three species are all much branched. One, <i>Equisetum sylvaticum</i> L., is found almost exclusively in or at the border of rather shady woods. It is a slender form with characteristically leaning stem and gracefully drooping whorls of branches. Another, <i>Equisetum palustre</i> L., is practically confined to open wet places. It has rather stout 4 to 7-angled, hollow branches. The above species cause less trouble in this country than the fourth, which is known as the Field Horsetail, <i>Equisetum arvense</i> , because of its usual habitat. This form, as stated above, has separate fruiting stems which come up early in the spring and bear the spore cones at their tips. Later the green branched form appears, no fruiting cones being ever found on it. It is widely distributed and more abundant than any of the other forms. It can be distinguished from <i>Equisetum palustre</i> by its solid 3 to 4-angled branches and by the larger cavity of its stem, this being one-half to two-thirds of the diameter in <i>Equisetum arvense</i> and about one-sixth in <i>Equisetum palustre</i> . From <i>Equisetum sylvaticum</i> it is ordinarily distinguishable by its much less abundant and less conspicuous secondary branching. Great numbers of secondary branches do occur, however, on the Field Horsetail when its main stem has been eaten or broken off. Then the whole aspect of the plant is changed, and it assumes a low bushy form that is even more distinct from the slender, graceful woodland species.
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FERN FAMILY—*Filicineae*.COMMON BRACKEN—*Pteris aquilina* L.

The Bracken Fern grows commonly in pastures and old hayfields, especially in shaded parts, and also in open woods. It has long been suspected of containing a poison, but definite proof was wanting until the publication in 1917 of the experiments of Drs. Hadwen and Bruce of the Health of Animals Branch of the Canadian Department of Agriculture. Their investigations have proved that it causes the disease called "staggers" which has given trouble to horse owners in British Columbia and some of the western United States. The following quotation from the work of these men will illustrate the extent of the harm which may be done: "During the hard winter of 1915-16 the mortality amongst horses in the Fraser Valley and on Vancouver Island was very heavy. As an extreme case we cite the following: In the little village of St. Elmo, B.C., out of twenty-four horses owned by eleven farmers, sixteen died of Bracken poisoning, four recovered, and the balance (four) did not take the disease."

The symptoms of the poisoning were determined by feeding experiments with hay to which a definite amount of Bracken was added. No irregularity was
Symptoms noticed until after several weeks of feeding, the first indication being generally an unsteady gait, accompanied by nervousness and constipation. Then the eye became congested, and later there was constitutional or systemic disturbance with manifest symptoms of intoxication. Increasing weakness finally rendered the animal unable to stand, or even to lie in a natural position. In this condition he showed great excitement and usually battered himself up badly before death ensued. The appetite was good throughout.



Fig. 4.—Bracken Fern—*Pteris aquilina*. Rootstock and frond.

In rare cases horses have been known to show similar symptoms from eating Bracken in pastures. Except in the case of very greedy animals, they will not eat the fern either in hay or pasture if a proper amount of ordinary feed is provided.

Drs. Hadwen and Bruce refer to the treatment recommended by Dr. S. F. Tolmie of Victoria, late Dominion

Treatment Minister of Agriculture, who has had a great deal of experience with such cases: "Remove all ferny hay and bedding. Administer a good brisk purgative, such as Barbados aloes seven drachms, calomel one drachm and ginger one drachm. Half-ounce doses of potassium bromide twice a day in the feed or drinking water. One or two drachms of potassium iodide three times a day is recommended. Give medicine in the feed or drinking water or with a syringe. Feed laxative food such as bran mash and carrots. Give enemas if necessary. When animal is very groggy place in slings with extreme care, avoiding excitement as much as possible. . . . In some cases cold packs to the head are recommended." In certain remarks for the farmer who is unable to secure professional aid, the importance of a warm, quiet stable and of guarding against excitement is emphasized, and as an alternative purgative a quart of raw linseed oil recommended.

The Bracken is of wide distribution, growing under a variety of soil conditions, in both hemispheres. Its

Description of The Plant slender, glossy, dark-coloured, underground stem forms a tough mat exposed on ploughing but below the level of the grass roots. It gives off at intervals rigid erect stalks, two to four feet high, bearing at their summits broad branching fronds. The firm, upright, rigid character of the leaf

stalk and the restriction of the foliage to its summit make a Bracken plot look solid from above but like a miniature open forest from within. In this respect the Bracken is distinct from our other native ferns, and so its habit forms an easy means of identification. At fruiting time the sporangia are also of value for identification. They are borne in a continuous line under the infolded margin of the leaflets.

GRASS FAMILY—*Gramineae*.

SKUNK-TAIL GRASS—*Hordeum jubatum* L.

Other Common Names: Squirrel-tail Grass, Skunk-grass, Wild Barley, and improperly in the Prairie Provinces, Foxtail.

No poisonous compound is contained in this grass, but it causes a great deal of trouble to horses, sheep and cattle owing to its sharp awns, which break and enter the mucous membranes of the mouth and gums. Horses are troubled much more than cattle, as their mouths are more tender. Inflammation, ulceration and formation of pus follow, and in some cases the gums are diseased to such an extent that the teeth become loose and fall out. A quotation from Dr. S. H. Johnson by Pammel, states: "I have seen lips eaten through, and tongues eaten almost off by the grass."

The plant is a biennial, or winter annual, growing in waste places and neglected fields, along roadsides and on the open prairie, especially on moist slopes and on cut-over sloughs. Its fibrous roots form compact, tangled masses. The stems are in clumps or in compact formations, from six inches to two feet tall, with slender leaves and dense fruiting spikes, turning a faded

**Harmful
Effects**

The Plant



Fig. 5.—Skunk-tail Grass—*Hordeum jubatum*.

yellow early in the season. Skunk-tail resembles ordinary Foxtail or Millet, but when the mature plant is once seen it will be always recognized by its longer slender awns which stand out conspicuously from the head giving a fancied resemblance to a skunk's tail. The spike is jointed, each joint having three flowers, the centre one, only, fertile and producing a seed. The fruits, which it sheds by breaking at the joints, are each accompanied by seven long, barbed awns in addition to the two small bristles to which the sterile flowers are reduced.

The plant should never be allowed to seed, and great care should be taken not to feed hay which contains mature plants. When young it is harmless.

The awns of Common Barley, Little Barley, *Hordeum secalinum* Schreb., and Wild Barley, *Hordeum murinum*

<p>Related Harmful Species.</p>	<p>L., produce the same effects to a lesser degree. These plants are closely related to Skunk-tail Grass. The two latter are weeds troublesome in the West.</p>
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LILY FAMILY—*Liliaceae*.

SWAMP CAMAS—*Zygadenus elegans*, Pursh.

Other Common Names: Smooth Camas, Cow-grass, Green Lily.

<p>Examples and Conditions of Poisoning</p>	<p>Owing to its coarseness, this species is not eaten by grazing animals to so great an extent as the Death Camas, described later among poisonous pasture plants (p. 50). It is equally poisonous, however, and western farmers have need to be cautious in cutting hay from wet meadows where it grows, for its seeds, which contain most of the poisonous substance, are usually mature at</p>
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Fig. 6.—Swamp Camas—*Zygadenus elegans*.

the time the hay is cut. One man, spoken of by Chesnut and Wilcox, used hay cut from a low meadow as winter feed for sheep. At the first feeding many of them became sick, and the rest of the hay could not be used. Considerable amounts of Swamp Camas were found in the hay, and no other poisonous plants were present. In another case six cattle were pastured on low, wet ground and two of them died. The symptoms were practically identical with those caused by Death Camas, and quantities of Swamp Camas were found in the stomachs.

Swamp Camas resembles Death Camas except that it is considerably larger and coarser, and grows in more swampy situations. As stated above, the effects produced by the two species are identical. This plant is probably more dangerous in hay than Death Camas, because it is larger and forms a greater proportion of the feed.

PEA FAMILY—*Leguminosae*.

LUPINES—*Lupinus spp.*

Other Common Names: Wild Pea, Wild Bean, Blue Pea, Blue Bean, Pea Vine.

In the west, where Lupines are very plentiful, their misuse as pasture and hay has been the cause of immense losses. Chesnut and Wilcox have enumerated a long list of casualties in Montana. Two hundred sheep were being moved, and were allowed to feed on a patch of Lupine. By next morning one hundred of the band were dead. Lupine hay was fed to one hundred and fifty bucks and as a result of one feed ninety died. Three two-year-old colts were fed ordinary hay most of the winter and then ate Lupine hay for two days, when all died.

Examples and
Conditions of
Poisoning



Fig. 7.—Common Lupine—*Lupinus perennis*.

In October, 1898, a snow storm covered the grass, and out of a band of 2,500 sheep, 1,150 died from eating the Lupines. During the winter of 1898-99 about 7,000 sheep in Montana were poisoned by Lupine hay, and of these over 3,600 died. Many more cases of a similar nature are recorded, and the evidence leaves no room for doubt as to the cause of death. In all cases the Lupines eaten bore pods containing mature or nearly mature seed.

The experiments of Marsh, Clawson and Marsh, taken along with those of other investigators, have established the fact that poisoning in this country is due almost exclusively to alkaloids, which are contained in all parts of the plant, but are more abundant in the seed. The toxic dose of these alkaloids is very nearly as large as the fatal dose, and smaller quantities have little or no effect on the animals. It thus happens that Lupines and Lupine hay containing no seeds may be wholesome and satisfactory as a feed, while plants with full pods are deadly poison. It has been established that the poison acts on horses, pigs, goats and cattle, as well as sheep. Cattle on the range usually leave the pods and so are rarely poisoned, but sheep eat them greedily.

The general symptoms of poisoning in the early stages are cerebral congestion and great excitement: in experiments with sheep this showed itself by their rushing about and butting and pushing. Later the movements become irregular and incoördinated, with spasms and falling fits. When the animal can no longer stay on its feet, convulsions like those caused by strychnin are often evident. The excretions of the kidneys are increased and are sometimes bloody. The immediate cause of death is usually respiratory paralysis, which ordinarily ensues in a half to one and a half hours. Some-

times in milder cases the animals live four or five days. In these cases the respiration becomes slow and laboured, the pulse is weak and the animals fall into a state of coma.

In horses there are certain special symptoms: dullness, contractions of the surface muscles, intestinal disturbances, usually manifesting themselves in constipation, but sometimes in diarrhoea. There is also a tendency to lift the forefoot high in walking.

The results of the search for antidotes have not been very satisfactory. Permanganate of potash has been recommended, but is useless unless given very early in the course of the attack. Vinegar and dilute sulphuric acid are also spoken of as chemical antidotes. Hypodermic injections of such sedatives as morphin or chloral hydrate are useful in controlling the convulsions.

According to Marsh, Clawson and Marsh: "There seems to be little doubt that, as in *Zygadenus* poisoning, if sodium bicarbonate can be administered at intervals frequent enough to catch the toxic principle as it enters the fourth stomach, recovery may be aided. This is of considerable theoretical interest, and the method might be used in order to save an especially valuable animal, but of course range animals cannot be treated in this way."

In Europe a species of Lupine, *Lupinus luteus*, has caused trouble, producing a disease called Lupinosis. Investigation shows this plant to be much poorer in alkaloids than our American species, and the symptoms of Lupinosis differ from those described above. There is loss of appetite, weakness and fever in the early stages. Acute atrophy of the liver is usual, giving rise to a yellow colour in the conjunctiva, mucous membranes

and body tissues. In some cases the ears, eyelids, lips and nose swell. In addition there is cerebral excitement, gnashing of the teeth, pain in the posterior region of the body, diarrhoea, and sometimes blood, bile and albumen in the urine. This disease is supposed to be caused by a substance to which the name ictrogen has been given. It is believed that ictrogen is produced by micro-organisms living on the Lupine leaves, and this theory is strengthened by the fact that while Lupines in some fields produce the disease, those of the same species in other locations are harmless. Lupinosis is very rare in America if, indeed, it ever occurs here. Dr. A. D. Knowles of Butte, Montana, had cases where some of the symptoms were present in horses.

In eastern North America only a few species of Lupine are found, *L. perennis* being most common, but in the west they are very plentiful. Rydberg lists
The Plant eighty species from the plains and mountains. They grow most frequently on dry hillsides and are often cut for hay. When fed to animals it is essential that no seeds be included.

They grow in tufts from a perennial root, and are easily recognized by the more or less wheel-shaped, palmately compound leaves, of entire, oblanceolate leaflets. The purple or whitish pea-shaped flowers are in loose spikes. The keel of the flower is scythe-shaped and pointed, and the filaments of the stamens are united to form a complete sheath about the ovary. The anthers are alternately oblong and roundish. The pod resembles that of the pea, and is often knotted by constrictions between the seeds.

Lupines are easily eradicated by cultivation, but their destruction in uncultivated land is impracticable where they are present in quantity.

SUNFLOWER FAMILY—*Compositae*.

WHITE SNAKEROOT, *Eupatorium urticaefolium* Reichard, and its symptoms are described among the harmful pasture plants, as it is in pasture that it causes most trouble. Its poisonous properties are not destroyed by drying, however, and the disease "trembles" is produced by hay in which White Snakeroot is included. (See p. 85).

SECTION II

Plants Dangerous in Pasture or on the Range

The plants in this division are more numerous than those of the preceding, in spite of the facts to which attention was directed. (See p. 17). Several circumstances are to be considered in this connection. Some poisonous plants thrive in early spring and are shrivelled and gone before the time for cutting hay arrives. Others lose much of their poisonous character with maturity, and some contain volatile poison which evaporates and is lost during the curing of the hay. In addition to these there are numerous poisonous plants which are never cut with hay but are often found in pasture and eaten by animals with fatal results.

GRASS FAMILY—*Gramineae*.

THE SORGHUMS—*Andropogon spp.*

The Sorghums are important forage plants and are wholesome under most conditions. In certain cases, however, they develop hydrocyanic or prussic acid, a most deadly poison. Literature on the subject records many cases of sudden and violent deaths. One example given by Glover and Robbins will serve for illustration: "At Brighton, Colorado, thirty-two cows, after being kept in the corral over night, were turned into a field of Kaffir Corn of not over two acres. . . . Twenty-one of them were dead in half an hour, and four of the others were badly affected."

Examples and
Conditions of
Poisoning

The formation of hydrocyanic acid is due to the action of an enzyme on a glucoside, which resembles that found in almonds. Neither the glucoside nor the enzyme is in itself poisonous. The enzyme is especially active when green sorghum is wilted, and the poison is said to be more plentifully produced in stunted plants, or those of second growth. When the Sorghum has been dried there is no danger, hydrocyanic acid being very volatile, and the enzyme responsible for its formation being in all probability destroyed by the drying.

The symptoms produced are very striking. Hydrocyanic or prussic acid is the most rapid poison known.

Symptoms Even the dilute form found in these plants causes symptoms in a few seconds, especially when taken on an empty stomach. The animal becomes giddy or staggers and falls. Heart action is slowed and breathing laboured. Spasms and twitching of the muscles are followed by numbness in the limbs, and finally by delirium and death. Bloating is sometimes observed in sheep and cattle, but is not always present. If only a very slight amount of the poison has been eaten the symptoms are less pronounced. Sorghum has, however, been known to become so poisonous that a few mouthfuls eaten on an empty stomach would kill a cow in ten minutes. An autopsy shows no pathological conditions but an analysis of the stomach contents of animals lately killed reveals the presence of hydrocyanic acid. The peach-like odour of the poison is usually quite noticeable.

Treatment is in most cases useless where any considerable amount of the poison has been ingested. The animal

Treatment should be placed with head raised, and, if possible, in the shade. If bloating occurs in cattle the paunch should be punctured, a handbreadth in

front of the hip bone. Injections of atropin sulphate serve to keep up the heart action. Sugar renders the poison inactive, and large quantities of corn syrup or molasses have been given with benefit. Treatment similar to that used for prussic acid poisoning in cyanide works is also recommended. One ounce of sodium carbonate (washing soda), and one-half ounce of copperas, each dissolved in a pint of water, should be kept on hand in separate, tightly corked, glass bottles. The solutions are mixed, and the mixture is administered at once. A quart is sufficient for a cow and one-half pint for a sheep.

Sudan Grass, Sweet Sorghum, and Kaffir Corn are varieties that have been found to produce death, and great care should be taken in feeding these
The Plants as well as the other Sorghums. The Sorghums are stout, broad leaved, annual grasses, ranging from three to fifteen feet tall, and have been introduced into this country as forage plants and for their seed. The large flowering panicles of different varieties vary greatly in shape. The spikelets are in pairs at each joint of the slender rachis, and the seeds are large, rounded and polished.

PORCUPINE OR SPEAR GRASS—*Stipa spartea* Trin.

Porcupine Grass has seeds which are admirably adapted for burying themselves in the soil. The fruit, where it connects with the plant, has a sharp barbed
Harmful
Effects point, and above this are numerous hairs pointing upward. When the seed falls with this point on the ground it is gradually worked into the earth by the movements of the hairs, due to moisture changes. Considerable injury is done to sheep by seeds, which get

fast in their wool and work themselves into the flesh. Long-haired shepherd dogs are also troubled in a similar way, and when people walk through the grass the fruits stick in their clothes and cause discomfort. If eaten by stock they work into the tissues of the mouth and throat and have even been known to perforate the walls of the stomach and intestine.

The plant is found from Manitoba to British Columbia and southward to Mexico. It is perennial, with stems
The Plant three to five feet tall, and with long, narrow leaves. The narrow panicles are four to twelve inches in length, twisted below and often bent sharply. The base of the dark brown fruit is sharply pointed and densely covered with hairs.

NEEDLE GRASS—*Stipa comata* Trin.,

is a close relative of Porcupine Grass and is quite often found in prairie hay. Its fruits produce the same effect, though to a somewhat less degree. If cut after the fruit has fallen it forms good hay.

CORNSTALK DISEASE.

In parts of the United States, and to a lesser degree in Canada, it is customary to gather the ears from the corn-field, leaving the stalks standing. Cornstalk disease in certain of such neighbourhoods causes the death of numbers of the cattle allowed to pasture on these stalks.

Alway and Peters investigated this disease in Nebraska. They obtained statements from 404 people in one county who had lost cattle to the number of 1,531 during the seasons of 1906 and 1907. Their information indicated that by far the greater number of deaths occur during the first month of pasturing, and more than one-

fourth during the first week. They found further that the number of losses is not reduced by admitting the cattle to the field for a short time only at first; also that a supply of feed in addition to the stalks makes very little difference. The further fact was established that animals which have contracted the disease very rarely recover.

The cause is still a mystery. The trouble is believed by many to be similar to forage poisoning, which comes from eating mouldy and immature corn or other similar fodder. There is a fundamental difference, however, in the fact that cornstalk disease attacks cattle, while forage poisoning is confined to horses and mules.

The danger seems to be obviated by cutting the cornstalks when ripe and shocking them. No remedy has been found for the disease when once contracted.

LILY FAMILY—*Liliaceae*.

DEATH CAMAS—*Zygadenus venenosus* Rydb.

Other Common Names: Poison Onion, Poison Lily, Poison Sego, Poison Camas, Hog Potato, Mystery Grass, Alkali Grass and improperly Lobelia.

Early explorers in Western Canada learned of the poisonous nature of this plant from the Indians, who had suffered by mistaking its bulbs for those of Camas and Wild Sego, which they used for food. People are still sometimes poisoned in the same way, but the chief harm is done to animals, especially sheep, on the western ranges. In early spring before the herbage is plentiful, the succulent, grass-like leaves look very inviting and are greedily eaten by sheep in spite of their somewhat bitter taste. The onion-like bulbs are equally poisonous, but are not pulled

Conditions of
Poisoning

up by the animals, except when a recent rain has softened the ground. Horses and cattle are affected by the poison as well as sheep, but they rarely eat enough to produce serious results. Soon after flowering the plant dries up and in this condition is unattractive to animals. The seeds are extremely poisonous and sometimes produce trouble when the plant is mixed with hay.

It has been established that the poisoning is due to zygadenin, an alkaloid of which the leaves and bulb contain about 0.6%, the root half as much and the flowers roughly 1.25%. The proportions may vary in different localities. The first symptoms noticed in sheep are uneasiness and erratic movements with laboured irregular breathing. Frothing at the mouth, nausea and regurgitation follow, often accompanied by spasms. In the later stages, if sufficient of the plant has been eaten, a complete collapse ensues, the animal lying stretched out as if dead, its shallow breathing scarcely perceptible. Experimental evidence indicates that death is due to a stoppage of the heart's action. Very little digestive trouble is found in adult sheep, but lambs which acquire the poison with their mothers' milk are attacked with enteritis and dysentery, usually dying in a few hours.

Chesnut stated that both horses and cattle are sometimes killed. Pigs are said to eat the bulbs with impunity, and as a result the name "Hog Potato" has been popularly used for the plant.

Various remedies such as soda, salt, lard and fat pork, have been recommended and used by stockmen, but with unsatisfactory results. A solution of permanganate of potash and aluminium sulphate gives good results at all stages of the poisoning. It is a chemi-

cal antidote, decomposing the poison that remains in the alimentary canal. Whether it neutralizes that which has been absorbed into the system is not apparent. It has, however, led to the recovery of many sheep in which the symptoms were far advanced. Five to ten grains of each chemical dissolved in a pint of water is the dose for a sheep. For horses, fifteen to twenty grains of each should be used, and for cattle thirty to fifty grains. Great care must be taken to have the potassium permanganate completely dissolved. In the case of animals which are prostrated a stimulant such as strychnin produces a slight improvement, but if used alone will not effect a cure. Diuretics, such as caffein or theobromin, are also useful as a stimulant to the kidneys. Care should be taken to keep the animal quiet.

Death Camas is a slender, light-green plant with narrow leaves, five to fifteen inches long, like those of common grasses but more succulent. When young
The Plant it is often mistaken for a grass, but may easily be distinguished by the fact that there is no ligule where the leaf joins the stem, and by its bulb, which is buried two inches or more in the ground, and resembles a young onion. The flower stem grows from five to twenty inches high and has a raceme of rather small, yellowish or greenish white flowers at its summit.

There are several different species of *Zygadenus* which grow in similar habitats to *Z. venenosus*. They all resemble it and produce like effects. They grow abundantly west of the Rocky Mountains, and in the
Other Species Prairie Provinces and neighbouring States. One of the most common of these is *Z. elegans*. Pursh (p. 38).

FALSE HELLEBORE—*Veratrum viride*—Ait.

Other Common Names: American White Hellebore, Swamp Hellebore, Indian Poke, Devil's-bite, Meadow Poke.

A European species of *Veratrum* is used as a drug, and the American forms contain the same alkaloids. Most cases of *Veratrum* poisoning are due to overdoses in medicine, but both men and animals have been poisoned accidentally by the plants. One historic case has been quoted many times in which a whole family was poisoned by leaves that had been prepared as greens. Chesnut states that on account of its acrid, burning taste, animals do not like the plant, but that young ones sometimes eat it with fatal results, and that chickens have been killed by the seeds.

Veratrin, the chief poison, produces an intense burning of the throat, and acts chiefly on the heart and spinal cord, but produces also vomiting, purging and abdominal pain. The symptoms as stated by Dr. Winslow are: "Salivation, vomiting or attempts at vomiting, purging, abdominal pain, muscular weakness, difficulty in progression, loss of power and general paralysis, muscular tremors and spasms, and, occasionally, convulsions. The pulse is unaltered at first, but later becomes infrequent and compressible, and finally thread-like and running. The respiration is shallow, the temperature is reduced, the skin is cold and clammy; there is semi-consciousness, loss of sight and death from asphyxia."



Fig. 8.—False Hellebore—*Veratrum viride*.

“Treatment,” he says, “should be pursued with cardiac and respiratory stimulants, such as amyl nitrate (by inhalation), alcohol, strychnin, and atropin; **Treatment** tannic acid as a chemical antidote*; opium to subdue pain, and demulcents to relieve local irritation in the digestive tract. Warm water should be given to smaller animals to wash out the stomach and assist vomiting, and quietude should be enforced. In man, fatal poisoning is rare, since the drug is spontaneously vomited.”

The plant is a coarse perennial from two to eight feet tall. The leafy stem grows from a thick erect rootstock.

The Plant The large leaves are entire and oval in shape with conspicuous parallel veins. They have sheathing bases, are smooth on top, hairy beneath and sharply pointed at the tip. The flowers are small and of the liliaceous type, yellowish green and with the parts moderately spreading. They are arranged in a broad panicle of spike-like racemes. The plant is found on moist hillsides, in swamps and wet woods, chiefly in the eastern half of the continent.

CALIFORNIA SWAMP HELLEBORE.—*Veratrum californicum*
Durand.

This form is more common in the west, growing in valleys among the mountains, and is stated to have caused the death of cattle and horses. It resembles the former species except that the flowers are whitish and in a looser panicle with long, narrow flower parts.

It produces effects similar to those of *Veratrum viride* and the treatment is the same. Chesnut and Wilcox have proved that a solution of potassium permanganate and

*For another antidote look under *Veratrum californicum*.

aluminium sulphate, similar to that used for *Zygadenus* poisoning, forms a chemical antidote, neutralizing the poison not already absorbed.

BUTTERCUP FAMILY—*Ranunculaceae*.

LARKSPURS—*Delphinium* spp.

The poisonous effects of European Larkspurs have been known for centuries. One species, *D. Staphisagria* L., called Stavesacre, was used as a poison for lice. Many species are common in the west of Canada and the United States, and have occasioned great losses among cattle on the ranges. Marsh and Clawson place them next to the "loco" weeds in the number of animals killed, and Glover, in 1906, estimated the annual monetary loss, in Colorado alone, at \$40,000. All parts of the plants are poisonous, the seeds most of all. Leaves and roots are most harmful in early spring. The effects gradually decrease until after flowering, when practically all of the alkaloids seem to collect in the seed and the rest of the plant becomes harmless.

Stockmen have blamed the Larkspur for a large part of their losses in both cattle and sheep, and until a few years ago this opinion was entertained even by those who should have scientifically investigated the matter. In 1916, however, Marsh and Clawson published an account of experimental work which led them to believe that sheep can withstand the poison, probably on account of its prompt excretion by their kidneys. In repeated instances sheep were fed large quantities of the plants and in no case was any injury produced. They found horses to be susceptible to the poison, though they do not voluntarily



Fig. 9.—Larkspur—*Delphinium* sp.

eat enough to harm them. In the case of cattle the results are quite different, the plant proving very poisonous, especially in the early spring when the cattle eat the young growth greedily. Poisoning also occurs at other times, when animals are changed to a new range, or in autumn when other plants are covered by snow and cattle are sometimes tempted to feed on the projecting seed capsules of the taller forms.

The principal poisons contained are two alkaloids, delphinin and staphisagrin, of which the former is the more harmful. The first symptoms noticed are a stiffness of the limbs, and a somewhat straddling gait. Respiration is slow at first, then rapid. In one heifer it increased to 128 per minute. The appetite is not much impaired and the brain functions normally, though the sick animals are easily frightened. There is constipation and abdominal pain, and in the later stages nausea and vomiting, from which death often results by suffocation. Bloating is sometimes present, but is not common before death, although taking place rapidly afterward. A quivering of the muscles and weakness is prominent, the legs crumpling up under the animal. Congestion of heart, lungs and central nervous system and inflammation especially of the rumen, the oesophagus and the pyloric end of the fourth stomach are post-mortem indications. The alkaloid evidently acts as a local irritant and a nerve depressant. If recovery takes place it is usually very rapid.

The treatment indicated is (1) magnesium sulphate to overcome the constipation, (2) a chemical antidote for the poison remaining in the stomach, and (3) injections of a physiological antidote for that which has been absorbed. Chesnut and Wilcox recom-

**Poisons
Contained and
Symptoms**

Treatment

mend a 1% solution of potassium permanganate and aluminium sulphate as a chemical antidote, one quart being enough for three to five cows, or seven to ten horses; and injections of one-half to one grain of atropin. Marsh and Clawson report poor results from this treatment and recommend the use of Epsom salts and injections of a combination of physostigmin salicylate, pilocarpin hydrochloride and strychnin sulphate, supplemented by hypodermics of dilute alcohol where weakness is very pronounced. All excitement should be avoided and the animal kept with its head higher than the rest of the body. Where bloating occurs, it should be relieved by paunching.

As noted above, many species of Larkspur are found in Canada and the United States, but a detailed classification is unnecessary. All have leaves with deep palmate lobes and flowers in a loose elongated terminal cluster. The flowers vary from bright blue to pale violet and yellow, both sepals and petals being coloured. Each is provided with a long spur. The glistening black seeds are contained in erect, horned capsules. The species are divided into two groups. The low Larkspurs grow from six inches to three feet tall and the foliage dies and dries up at seeding time. The tall species are three to six feet high, and retain their leaves for a longer period.

MONKSHOOD—*Aconitum* spp.

Other Common Names: Friar's Cap, Wolfsbane, Iron Hat.

Rydberg lists three members of this genus from Western Canada. One of these, *Aconitum columbianum* Nutt.

is found in the lower parts of the mountains and sometimes poisons stock, though it is so thinly scattered that

**Symptoms and
Conditions of
Poisoning**

losses are comparatively rare. Its chief effect is on the heart and blood vessels, but there are also characteristic secondary effects. The pulse becomes very weak.

Bloating is common and nausea and retching are present in all cases. There is apparently a considerable feeling of constriction in the throat, giving rise to repeated attempts at swallowing. The pupils are dilated. Horses sweat profusely and become so weak as to be unable to stand. Death is usually caused by asphyxia. The poisonous character of other species is a matter of history. The European form, *Aconitum Napellus* L., is the source of the drug aconite, and an Indian species *Aconitum ferox* Wall., is used by natives of the Himalayas as an arrow poison.

Concerning the treatment for aconite poisoning in persons, Chesnut, in 1898, wrote as follows: "No specific

Treatment

antidote is recognized, but physicians have used atropin or digitalis and nitrate of amyl with good effects. The ordinary emetics and stimulants must be given. Artificial respiration should be continued for a couple of hours if necessary, and a recumbent position must be maintained through the treatment."

Tannic acid is recommended by Gail and Hahner as a chemical antidote. All agree that the use of heart and respiratory stimulants is an important part of the treatment.



Fig. 10.—Monkshood—*Aconitum napellus*.

The plant arises from a perennial rootstock. It has alternate, palmately lobed leaves which resemble those of certain of its near relatives, the Larkspurs, with which it is often confused, especially in the younger stages. The flowers, too, are arranged as in Larkspurs. They are large and one of the irregular coloured sepals forms the "hood." The five small petals are all alike. The stamens are numerous and the three to five carpels are partly united to form a horned seed capsule as in the Larkspurs. Though similar in many respects, Monkshood and Larkspur may be easily distinguished when in flower by the presence of the hood in one case and the spur in the other.

PASQUE FLOWER—*Anemone patens* L., var. *Wolfgangiana* (Bess.) Koch.

Other Common Names: Prairie Crocus, Prairie Anemone, American Pulsatilla, Prairie Smoke.

Willing mentioned this plant as causing the death of sheep in Alberta, concluding that the trouble was due to the formation of felt-like balls (phytobezoars) of the hairs with which the whole plant is plentifully provided. In addition to this Pammel notes the presence of a very acrid poison, a crystalline substance anemonin, which, in the fresh plant, has given much inconvenience to collectors, producing an inflammation of the eyes and even blistering the skin where wet by the juice. The drug is used by homœopathists.

**Harmful
Effects**

The Pasque Flower is one of the most beautiful plants of the prairie, but is not confined to this region, extending also to British Columbia. The large purplish flowers appear early in March on leafless stalks. Later the three-divided leaves appear. At first these and the stalk are covered with a dense coat of silky hairs which persist, but are more scattered, when the plant is fully grown. They form a valuable means of identification. The flower resembles in shape and size a small crocus and this has probably led to one of its popular names—the Prairie Crocus. It owes its beautiful crocus-like appearance to its coloured sepals,* the petals being small and stamen-like. The stamens and pistils are numerous, the latter, in fruit, forming a fluffy head, with the long styles developed into feathery tails.

ROSE FAMILY—*Rosaceae*.

WILD CHERRIES—*Prunus* spp.

The Wild Black or Rum Cherry, *Prunus serotina* Ehrh., is a common tree extending from the east to the prairies. The danger from it lies in the presence of prussic acid in the wilted leaves. Animals may thus be poisoned by eating the leaves from broken branches. The toxic substance is also contained in the seeds. The symptoms and treatment for prussic acid poisoning are given under Sorghum where they may be consulted.

The tree is large, with reddish brown branches, and an aromatic inner bark. The latter is bitter, as in all the cherries, and is valuable for distinguishing their

*There are five of these in the Pasque Flower while in the Crocus proper there are six.

twigs from those of other trees, especially the birches. The leaves are oblong, thickish, shining above and taper-pointed, with incurved, short teeth. The small creamy-white flowers are in elongated racemes and the fruit is shiny, purplish black and has a pleasant taste.

The Choke Cherry, *Prunus virginiana* L., is also dangerous in the same way as the Black Cherry, and has much the same distribution. It is a shrub or small tree with grayish bark, the inner layers of which have a disagreeable odour. The leaves are thin, abruptly pointed, sharply serrate with slender teeth, and the fruit is red, turning dark crimson, and very astringent. Willing, writing of conditions in Alberta, where the plant is often abundant and small, cautions against the use of hay containing recently wilted young shoots.

The Western Choke Cherry, *Prunus demissa* Walp., is a shrub or small tree with leaves thick and oval or obovate, more or less obtuse and with short teeth. The fruit is black and less astringent than that of *P. virginiana*. The toxic effects are similar.

The Wild Red or Pin Cherry, *Prunus pennsylvanica* L., is a small tree growing from Newfoundland to the Rocky Mountains. It has light brown bark, leaves ovate or lanceolate, sharply and finely serrate, and small, bright red, sour fruit in corymbose clusters, like those of the cultivated cherry. Poisoning may take place as in other species of *Prunus*.

It is to be noted that the chief danger from all the cherries is from the wilted leaves. Care should be exercised to prevent stock from browsing on branches broken from trees, for example, after cherry-picking, or when haying, or droving cattle.



Fig. 11.—Wild Black Cherry—*Prunus serotina*.

PEA FAMILY—*Leguminosae*.

STEMLESS LOCO WEED—*Oxytropis* spp. DC., also known as
Aragallus.

Other Common Names: Loco Weed, Crazy Weed, Loco Vetch, White Loco.

For many years stockmen of the west have been suffering great losses from the disease known as "Loco." Several agencies have at various times been held responsible for the trouble. One opinion was that animals not regularly supplied with salt acquired the disease from eating the alkali so common in certain soils of the plains. This idea has been shown to be erroneous since cases of "locoing" have become known on ranges where the alkali could not be obtained. Various plants were also blamed for the trouble and investigation has proved that this is correct, there being now several distinct species of recognized Loco weed.

The disease takes a peculiar course, not unlike the development of the drug habit in human beings. Horses and sheep are the animals usually affected, but cattle also become locoed in some cases. Animals may be pastured for years on ranges where the Loco Weed is found and show no ill effects, as they ordinarily avoid it. When one of them acquires the taste, however, it develops a craving for the weed and hunts it incessantly. Sheep acquire the habit by imitation, and so it is important to remove all locoed animals at once from the flock.

In chronic cases of locoism an immunity is developed, so that increasing quantities are necessary to produce characteristic symptoms. In such cases there is a continual craving for Loco Weed, the animal nervously searching it out and feeding on it. Locoed sheep become more and more emaciated

The Loco
Disease

Chronic
Locoism



Fig. 12.—Stemless Loco Weed—*Oxytropis Lamberti*.

and the fleece drops out in patches. There is an uncertainty and incoördination of the muscular movements, comparable to that exhibited in cases of drunkenness. The animal wanders aimlessly about, straying from the flock. Sight and hearing are affected. In some cases complete blindness ensues, and in others the animal is unable to judge the size of objects, or its distance from them. In later stages fits of trembling follow each other at short intervals and the power of locomotion is gradually lost. Death comes from exhaustion and lack of nutrition.

Cattle and horses sometimes become dangerous. Cattle have been known to attack persons or other animals. Locoed horses may work as usual for some time and then develop vicious fits of kicking. Their lack of judgment of the distance and size of objects is often very marked. They become easily frightened at imaginary objects and run away. As is the case with sheep, they become stupid and lethargic as the disease progresses. Chesnut and Wilcox tell of one horse that spent two weeks without moving from a spot of dry ground one hundred and fifty feet square. The horse then walked some distance to a stream and in attempting to drink, fell and was unable to rise.

When a large quantity of the weed is eaten by an animal unused to it, acute poisoning results. The symptoms are much more violent than in chronic cases.

Acute	
Locoism	In a case described by Chesnut and Wilcox the animal, a sheep, was completely blind within ten hours after she was first observed eating Loco Weed. She exhibited locomotor ataxia, walking in circles with her head bent to the right. As the disease progressed the circles became smaller. Pronounced muscular twitchings

were observed and forcible grinding of the jaws, these symptoms preceding a spell of walking. The pulse, at first irregular, became normal on the second day, and later very rapid and weak. Respiration also became progressively more rapid during the course of the disease. Death occurred on the morning of the fourth day, after a period characterized by muscular twitchings and inability to stand.

No satisfactory cure has been found for loco disease. Sheep that have acquired the habit, if taken in time, may be removed from Loco-infested areas and converted into mutton by the use of plentiful feed of a succulent nature. They should never be returned to the range, however, as they will at once begin again to eat the Loco. Horses that have been affected are never safe afterward, becoming frightened or vicious at most unexpected times.

Hundreds of thousands of dollars have been spent in attempts to rid the sheep ranges of Loco Weeds, but the results have been unsatisfactory. If care is taken to remove at once any sheep that has become locoed, no great losses will occur. One experienced sheepman is said by Chesnut and Wilcox to have lost so many sheep from Loco Weed that he decided not to continue the business. He sold his ranch to a stranger, who stocked it with sheep from another part of the country and had no trouble. The new flock contained no locoed animals from which the healthy ones could learn the habit.

There are thirty-four species of *Oxytropis* listed from western North America and of these twelve are reported from parts of Canada. Several have been proved poisonous, the one most commonly blamed being *Oxytropis Lamberti* Pursh. All species

with the exception of two, *O. deflexa* (Pall.) D C., and *O. foliolosa* Hook., are acaulescent, i.e., lack stems and have leaves and flower-stalks growing in tufts from the root-crowns. The whole plant, including the leaflets of the pinnately compound leaves, is covered with numerous whitish hairs. The flowers are of the legume type, ranging from yellowish white to blue and brilliant purple,

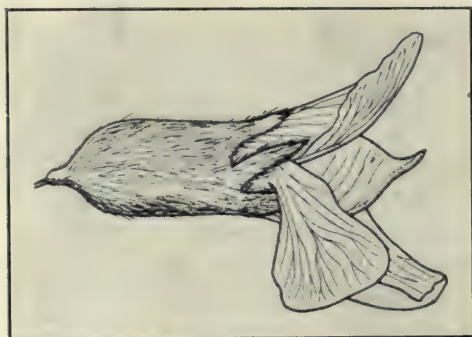


Fig. 13.—Flower of Stemless Loco Weed, showing “spur” (centre right), on the keel.

and borne in spikes or narrow racemes. They are distinguished from those of the closely related genus *Asragalus* by the presence of a spur-like point, one-eighth inch long, at the tip of the keel. The flowering season is June and July and it is at this time that the plant is eaten most freely, though animals that have acquired the habit will search out and eat the fruiting plants.

LOCO WEED OR MILK VETCH—*Astragalus* spp.

The resemblance between these plants and the stemless Loco Weeds is marked. They may, however, usually be distinguished by the presence of leafy stems, but always, as stated above, by the absence of any spur at the tip of the keel in the blossoms. Of the seventeen species listed by Rydberg, a number are undoubtedly responsible for loco disease and are as poisonous as the Stemless Loco Weeds. One species, *Astragalus mollissimus* Torr., has caused great losses in parts of the western United States. Chesnut says the damage done to the live-stock business by this weed is immense. The State of Colorado paid out nearly \$200,000 in bounties between 1881 and 1885, to check its ravages.

Barium salts have been suspected as the toxic substance of the Loco Weeds.

HEATH FAMILY—*Ericaceae*.LAURELS—*Kalmia* spp.

Several poisonous species of *Kalmia* are found in Canada and the United States, growing in dry places and in bogs. Their leathery leaves, and, in fact, all parts of the plants, contain andromedodextrin, a substance stated by Chesnut to be more poisonous than strychnin, though it is almost the reverse in its action. Grouse and deer appear to be immune to its effects. When they have fed on it, however, their flesh is said to be poisonous to human beings and to other animals. It is reported that people have been poisoned by eating honey extracted from the flowers.

Poisoning
by Laurels



Fig. 14.—a Mountain Laurel—*Kalmia latifolia*; b Pale Laurel—*Kalmia polifolia*.

Cattle, sheep, horses and goats have died from eating the leaves, *Kalmia latifolia* probably causing most deaths. Care should be taken to avoid laurel thickets when herding animals in spring, as the evergreen leaves are tempting.

Cases of human poisoning arise from the use of contaminated meat or honey, from overdoses in "home made" medicine, and from mistaking the young shoots for those of wintergreen. The leaves have been used to increase the intoxicating effect of liquors, sometimes with disastrous results.

Irregular breathing is a very characteristic symptom. In addition we have persistent nausea, salivation and
Symptoms grating of the teeth, together with dizziness and loss of sight and feeling. Stupor and death follow. In man there is intense headache, perspiration, tingling in the skin, and much vomiting.

As antidotes for the poison, Chesnut suggests atropin
Treatment or strychnin. He recommends also the use of oil, fat or melted lard when symptoms are first noted.

The Mountain Laurel, *Kalmia latifolia* L., is found on rocky hills and dry slopes from the eastern coast to
The Plants Ontario and southward. Miss Fyles quotes Barton, who wrote in 1798 that this species was poisonous to animals and was used by Indians as a means of suicide. In Canada it is a shrub, usually not more than six feet high, but grows much larger in some parts farther south. The evergreen, short-petioled, usually alternate leaves are ovate-lanceolate or oblong, thick, and bright green on both sides. The beautiful pink flowers are flat with a raised edge and depressions for the anthers of the ten stamens. They are one-half

to one inch broad, in terminal corymbs, with clammy-pubescent stalks. The seed-pods also are glandular.

The Sheep Laurel or Lambkill, *Kalmia angustifolia* L., is found from Labrador to Ontario and southward on hillsides, and in pastures and bogs. It is usually not more than three feet high, and the leaves, smaller than those of the mountain Laurel, are usually opposite or in threes and are pale beneath. The lateral corymbs of crimson flowers are slightly glandular. The flowers are less than one-half inch in diameter.

The Pale Laurel, *Kalmia polifolia*, Wang., extends across the northern part of the continent and stretches south through all but the Prairie Provinces, being found on mountains and in cold bogs. It is a straggling shrub, not more than two feet high, with opposite, oblong leaves, white-glaucous beneath and with revolute margins. The terminal corymbs have each a few rose purple flowers two-fifths to one inch broad.

CARROT FAMILY—*Umbelliferae*.

WATER HEMLOCK—*Cicuta* spp.

Other Common Names: Wild Parsnip, Spotted Hemlock, Beaver Poison, Musquash Root, Cowbane, Spotted Cowbane.

Several species of the Water Hemlock grow commonly in Canada. Parts of these are deadly in their effects. This fact was well known to the Indian by whom the root, the most poisonous part, was sometimes used for self destruction, being very rapid in its action. Cases of accidental human poisoning also occur. The roots have a sweetish and not unpleasant taste, and a rather parsnip-like odour. They are occasionally eaten by chil-



Fig. 15.—Water Hemlock—*Cicuta maculata*. *a* Upper leaves and flower-clusters; *b* Thickened rootstock with cross-partitions, and fleshy roots about one-third natural size.

dren and even by adults, who mistake them for the aromatic roots of harmless plants.

During May and June, 1900, Chesnut and Wilcox noted in Montana thirty-six cases of Water Hemlock poisoning among cattle, and one hundred and five among sheep. Thirty of the cattle and fifty of the sheep died. The poisoning occurs under various circumstances. Chesnut states that the seeds are sufficiently poisonous to cause loss when the mature plant is cut and fed with hay, but Marsh believes that this is a mistake. However this may be, there is no doubt of the poisonous character of the root and young shoot. Cases have been reported of horses killed by eating the roots upturned by the plow. Animals have also been reported to have been poisoned, especially in the spring, by drinking water from wet places where the Water Hemlock grew. The poison was considered to have got into the water from the juices of the roots crushed by the trampling of the animals themselves. Cases of poisoning by the young shoots are also on record. Although the stem and leaves of the mature plant contain little poison, it has been repeatedly proved that the young plant, six inches or so in height, contains it in sufficient quantity to be a source of much danger. This early spring stage is especially attractive when other green stuff is scarce, and the ground being wet at this season of the year the roots are readily pulled up by the grazing animal, and form an added menace. We are indebted to Dr. C. D. McGilvray, now Principal of the Ontario Veterinary College, for the details of an interesting case of stock poisoning by this spring growth of the Water Hemlock. It came under his observation when he was stationed at Winnipeg. Twenty-one head of cattle were turned out to pasture between 9 and 10 a.m. and at

3 p.m. nine were found dead and several sick, one of the latter dying while the herd was being removed. On examination of the place where the dead animals were found, a piece of marshy land near the shore of Lake Winnipeg, it was discovered that the whole area was overgrown by the young shoots of the Water Hemlock. The stomach contents of the dead animals proved to be composed chiefly of this young growth with a few roots. In this particular area cattle had pastured in former years with impunity, the young Water Hemlock having been concealed by the previous year's growth of marsh grass, but this season the grass cover had been burned off. Another peculiar feature of the case was that the younger members of the herd were not affected. This apparent immunity was found to be due to their having been driven away from the tempting shoots by the older animals.

Some writers state that the plant is most poisonous in winter and spring. Others believe that the effects in autumn are just as deadly. All agree, however, that during the hot summer season a larger quantity may be eaten without harmful results. Jacobson has discovered the reason for this. In his investigations of the properties of cicutoxin, the poisonous constituent, he found that it is very sensitive to rises in temperature, becoming polymerized by heat.

The poison is very rapid in its action, and a very small quantity will produce death. Soon after eating severe abdominal pain manifests itself. Great mental excitement develops into a frenzy. There is often frothing at the mouth. Respiration is laboured and often irregular. The pulse is intermittent. Convulsions follow and death ensues, sometimes within fifteen min-

utes of the time when the poison was eaten, but more often in two or three hours.

Treatment is generally very difficult, owing to the rapidity and violence of the attack. In one case a cow was treated by opening the stomach as soon as symptoms were noticed, and removing the contents. This, together with a large enema of warm water and a drench of melted lard, produced a cure. Potassium permanganate solution is recommended as a chemical antidote, as is also tannin, but their effectiveness is in dispute. Chloral hydrate and morphin injections are useful for reducing the nervous symptoms and frenzy, the latter being preferable, perhaps, owing to its more rapid action.

Cicuta maculata L. is the most widely distributed Water Hemlock in Canada, growing in moist locations probably across the continent. It is from two to six feet tall and crowned with large compound umbels of white flowers, which are later replaced by ellipsoid fruits with large oil tubes. The lower leaves are large, and two or three times pinnate. The upper are smaller. All have long petioles, sheathing the stem completely at their insertion. The leaflets are lanceolate or oblong lanceolate and coarsely serrate. The stems are hollow, with solid partitions at the leaf nodes. The short, bulbous rootstock has many cross-partitions closely approximated, as may be seen by slicing it lengthwise through the centre. Around its base are smaller roots not unlike very small sweet potatoes in appearance.

The Oregon Water Hemlock, *Cicuta vagans* G., is found in British Columbia, and the States to the south. It is of this species that Hedrick makes the statement that a piece of root the size of a walnut will kill a cow.

It is a somewhat smaller plant than the preceding and is distinguished from it by its orbicular fruits with small oil-ducts. The leaflets also are less sharply serrate.

The Bulbous Water Hemlock, *Cicuta bulbifera* L., is found in the eastern provinces, Ontario, Manitoba, British Columbia, and the adjacent states to the south. Like the other species it is very poisonous. It is a slender plant, one to three and one-half feet high. Its leaflets are linear and sparingly toothed. The upper leaves have clusters of bulblets in their axils.

POISON HEMLOCK—*Conium maculatum* L.

Other Common Name: Spotted Parsley.

The poisonous effects of *Conium maculatum*, a plant introduced from Europe, were known long before the beginning of botany as a science. The juice, made famous on account of its connection with the death of Socrates, was used by the ancient Greeks for the execution of criminals. The poisonous principle (coniin) is found in all parts of the plant. It is particularly abundant in the leaves at flowering time, and is plentiful in the seeds, especially when green. During the spring the roots are almost harmless, but they become very poisonous in the summer. The coniin is a volatile alkaloid, and thus Poison Hemlock plants dried in hay are not very dangerous.

The symptoms are a gradual loss of muscular power, owing to paralysis of the motor nerve centre. Convul-

Symptoms and Conditions of Poisoning sions are not present and the mind usually remains clear until death, which results from paralysis of the lungs. Horses, in addition to the above symptoms, exhibit nausea, intermittent sweating, muscular tremors and in-



Fig. 16.—Poison Hemlock—*Conium maculatum*.

creased rates of pulse and respiration. In cattle also the pulse is accelerated and there is salivation, bloating and great pain. A small quantity is sufficient to produce marked effects. The plant has a disagreeable odour and is coarse and unattractive when full grown. In early summer, however, the leaves are succulent and are sometimes eaten by grazing animals.

Chesnut recommends the following treatment: "Use of the stomach pump or emetics, tannin, tea, oak bark, stimulants, warmth at the extremities, artificial respiration and the subcutaneous injection of atropin."

The plant, though introduced from Europe, is found throughout the east to the Great Lake region, and again in the mountains of the west. It is an erect, biennial, branching plant, two to six feet tall, with a hollow stem spotted with purple. The leaves are large and pinnately decomposed, with much-dissected leaflets, the ultimate divisions resembling parsley in appearance. The flowers are small and white, in large compound umbels. The fruit is smooth, ovate and flattened, with prominent, wavy ribs. It has no oil ducts. The tapering root is about an inch in diameter and has an odour like that of parsnip. The rest of the plant, when crushed, produces the characteristic foetid odour of coniin.

THE WATER PARSNIP—*Sium cicutaefolium* Schrank.

Miss Fyles reports cases from different parts of Canada where animals have died from the effects of Water Parsnip. Symptoms and treatment have not been worked out. The poison apparently acts on the kidneys.

It is common in wet places and of wide distribution. It is an upright branching plant from two to six feet high. The pinnately compound leaves have long, narrow, sharply toothed leaflets. The lower ones are long petiolated, the upper almost sessile. The white flowers are borne in compound umbels with narrow bracts.

SUNFLOWER FAMILY—*Compositae*.

RAGWORT—*Senecio Jacobaea* L.

Other Common Names: British Ragwort, Tansy-ragwort, Staggerwort, Stinking Willie.

Stockmen in eastern Canada formerly lost considerable numbers of cattle through a mysterious ailment called "Pictou Cattle Disease." The liver was the organ especially attacked. Long periods of nervous irritability and gradual emaciation were followed by increasing weakness and death. An investigation of the disease by the Canadian Department of Agriculture proved the correctness of suspicions held by farmers for years, that Ragwort was the cause. Since that time experience in England and New Zealand has corroborated this conclusion.

Both in pasture and in hay, Ragwort has proved poisonous to cattle and, to a lesser extent, to horses.

Symptoms Sheep generally eat it with impunity. The effect of the poison is apparently cumulative, and animals may feed on the plant for months before characteristic symptoms develop. Then the hair loses its lustre, the animal becomes irritable and nervous, with occasional chills, followed later by a paleness of the



Fig. 17.—Ragwort—*Senecio Jacobaea*.

mucous membranes, emaciation, staggering gait, great weakness and death.

Strychnin and iron are of some benefit during the early stages, but a dependable cure for the disease has not been discovered. Therefore preventive measures are most necessary. In eastern Canada cultivation and pasturing with sheep have been made use of with some success for the eradication of the plant, but it is still very plentiful in waste areas.

Ragwort is a European introduction. It grows abundantly in the east and locally as far west as Ontario.

The Plant It is an erect plant eight inches to two feet or more in height, and may be smooth or more or less covered with woolly hairs. The root leaves are lyrate, while those on the stem are deeply pinnately dissected or divided into small lobes. The bright yellow flower-heads, about one-half inch across, contain both tubular and ray florets as in the daisy, and are arranged in a flat-topped cluster. The plant blooms in July and August and forms a very striking feature of the landscape.

SNEEZEWEED—*Helxium autumnale* L.

Other Common Names: False Sunflower, Swamp Sunflower, Yellow Ox-eye, Staggerweed.

This native plant is found in moist places throughout the country, and contains poison in all its parts, but more particularly in the flowers. In powdered form the plant is used to some extent in medicine, producing violent sneezing when inhaled.

The flavour is bitter, and animals usually leave it alone. Chesnut states, however, that it often poisons cattle, horses and sheep that have been lately moved to places where it is plentiful. It is claimed that a taste for the plant is developed, inducing the animal to eat an amount sufficient to produce death. Horses and mules are more susceptible than other animals.

“The symptoms, as determined by experiments made in Mississippi upon calves, are an accelerated pulse, difficult breathing, staggering, and extreme sensitiveness to the touch. In fatal cases, death is preceded by spasms and convulsions.” (Chesnut).

Melted lard is a most effective remedy, and relieves the symptoms in so short a time that investigators have been led to believe that its action is merely that of an emollient, relieving the burning in the alimentary canal. When this relief is obtained the nervous symptoms cease at once.

The plant is an erect branching perennial, somewhat downy, and from two to six feet high. Each of its numerous flower heads, an inch or more broad, consists of a globular mass of yellow disc florets, surrounded by a row of fertile yellow rays. The leaves are lanceolate, sessile, rather thick, and usually toothed.

WHITE SNAKEROOT—*Eupatorium urticaefolium* Reichard.

Other Common Names: White Sanicle, Indian Sanicle, Squawweed, Richweed, White Top, Deerwort-boneset.

There are few American plants whose poisonous properties have caused so much controversy as those of **White Snakeroot**. The disease called "trembles," which has lately been conclusively traced to it, was for many years a mystery. **Trembles or Milksickness** The trouble was formerly prevalent among animals feeding in wooded pastures, affecting more especially cattle and sheep, particularly in some of the eastern and central United States. It was variously attributed to bacteria, to a poison in the soil, to exhalations from the swamps, and to the bites of insects or small arthropods. Farmers learned that if they fenced their cattle away from the woods and swamps the disease did not trouble them. The serious character of the disease was increased by the fact that it was communicated to human beings by the milk of animals suffering from it. People who acquired it rarely recovered, and those who did survive were victims of permanent nervous debility. The fact of its communication by means of milk led to the application of the name "milksickness" to the disease.

The symptoms usually develop when cattle are out in pasture. Some stockmen believe that the disease is more prevalent in autumn. This may be due partly to the fact that unusual exercise and excitement hasten the development and increase the intensity of the symptoms, so that the disease becomes more apparent at the time when stock is being driven to market. The scarcity of other pasture at this season would also lead to the ingestion of larger amounts of the plant. In rare cases animals are attacked in winter, when, according to experienced stockmen, the disease comes as a result of the feeding of swamp hay. This fact is significant, as such hay is the only winter feed likely to contain White Snakeroot.

**Conditions for
Development of
Disease**



Fig. 18.—White Snakeroot—*Eupatorium urticaefolium*.

Wolf, Curtis and Kaupp of the North Carolina Agricultural Experiment Station, have recently published an extensive account of their researches on "trem-
Symptoms bles," in a special bulletin. From the results of feeding experiments they traced the disease to the White Snakeroot. Their treatise gives a complete and valuable account of the symptoms as observed by themselves and by others.

Cattle exhibit listlessness, stiffness of joints and sluggishness with weakness and trembling, especially when driven. There is constipation and a foul "garlicky" breath. It is noted that among a group of animals, some may escape harm while others contract the disease, though all have eaten the plant apparently to the same extent. In sheep, in addition to the above symptoms, the following are noted: loss of appetite, gritting of the teeth, quick, laboured breathing, marked ataxia, frequent and scanty urination. The trembling is very pronounced and accompanied by tetanic spasms.

In pigs the appetite is not impaired until the later stages but the trembling is very violent.

In man there is abdominal pain, vomiting, and excessive thirst; otherwise the symptoms resemble those in the lower animals.

No satisfactory cure for the disease has been discovered and the chances for such a discovery are not hopeful, as the poison produces fundamental
Prevention
The Only Cure changes in the internal organs. The only way of overcoming the disease, therefore, is by not allowing the animals access to the Snakeroot. Pasture areas infested by it should be fenced off or cleared of trees and broken up by the plow.

The plant is a native perennial, growing from New Brunswick to Ontario and south of the line, in damp woods, especially on their borders and in land recently cleared but not broken up. Its slender branching stem is one and one-half to three and one-half feet high, with opposite long-petioled leaves, broadly ovate and with coarse, sharp teeth. There is a characteristic mat of dark brown fibrous roots. The small flower heads, one-quarter of an inch or less in diameter, are white, and arranged in close compound clusters.

SECTION III

Plants Dangerous in Ground Feeds

Many plants have poisonous seeds. Indeed in many species there is a tendency for the poison to be collected from other parts of the plant and concentrated in the seed. These poisonous seeds are of great importance in Canada, where they form a considerable proportion of the screenings, millions of bushels of which are cleaned from grain annually. It has been customary for millers to mix the screenings from the wheat they grind, with their bran and shorts. In the early days the screenings obtained at the large grain elevators of the west were destroyed, but of late years they also have been used in the manufacture of feeds. This practice, which has been fairly successful in the United States, has caused much trouble in Canada, where the screenings on the average contain a much larger proportion of poisonous seeds. The loss from this source has been confined, for the most part, to swine. Complaints have, however, come from men in other branches of the livestock business, especially those engaged in dairying, who claim that a great deal of sporadic abortion has been caused by the use of feed containing screenings.

Much investigation into the character of our native weed seeds is still needed, and it is probable that species not now known to be harmful will be definitely proved so in the future. This section gives a resumé of the facts so far ascertained.

GRASS FAMILY—*Gramineae*.DARNEL—*Lolium temulentum* L.

Other Common Names: Poison, White or Bearded Darnel, Tares.

The history of Darnel is interesting. The plant has been known and its ill effects noticed for hundreds of years. It is believed to be identical with the tares of Scripture. The seed, being of approximately the same size as the grain, had to be separated by hand, the women performing this tedious task on the flat housetops.

There are many cases where people have been badly poisoned by eating Darnel in bread or meal, but few if any deaths are recorded. This is not true of the lower animals, many of which have been killed by eating it in ground feeds. **Conditions of Poisoning** Pigs, horses and sheep have suffered most. At the Lyons Veterinary School a horse was fed 4.4 lbs. of the seed and died as a result. Cornevin states that Darnel in the proportion of 0.7% of the weight of a horse will produce death, while 1.5 to 1.8% is required to produce the same result in ruminants and poultry.

The seeds only are poisonous, their effect being due to the presence of the alkaloid temulin, of which they contain, according to reputable analysts, 0.6% by weight. In the fruits of some 70% to 80% of the plants is a fungus which lives symbiotically with the plant, and is supposed by many to cause the trouble. This fungus forms a layer of hyphae just outside the aleurone layer of the grain. It has never been observed to produce fruiting bodies or spores, and **The Poison Substance**

its relationship is not known. As the seed sprouts the fungus keeps pace with the growth of the young plant, and finally affects the grain again. Feeding tests which would prove whether the fungus is responsible for the poisoning have not been made.

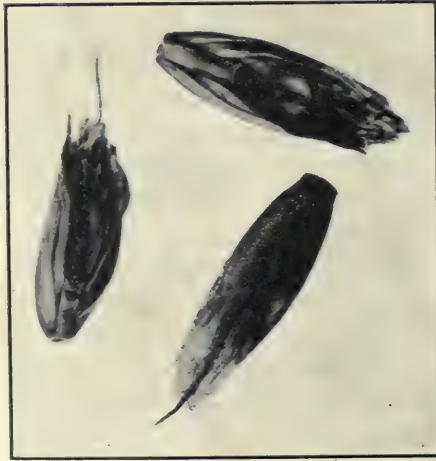


Fig. 19.—Grains of Darnel—*Lolium temulentum*. Five times natural size.

The symptoms are those of a deliriant nerve poison. There is confusion of sight which was known in very early times and is mentioned by classic writers. Further symptoms are dilation of pupils, giddiness, drowsiness, staggering and stupefaction. Trembling is followed in some cases by convulsions. In others vomiting and purging may take place. The respiration is laboured and the pulse slow. Inflammation of stomach and intestine have been observed.

The plant was introduced from Europe. It is most plentiful along the eastern and western coasts, but is found locally in the interior, growing in waste places and among grain crops. It is an annual grass from two to four feet high, with a smooth, stout stem, and rather broad leaves, rough above. The spikelets, each containing four to eight seeds, are arranged alternately, pressing into slight curves in the rachis, or main stalk. The fruit, which alone produces trouble, is not unlike a small grain of barley in appearance. The hulls enclose the kernel very tightly, the outer one being hard and flinty, and the inner minutely bristly along the edges. The size is about that of a small grain of wheat.

**The Plant
and Seed**

PINK FAMILY—*Caryophyllaceae*.

PURPLE COCKLE—*Agrostemma Githago* L.

Other Common Names: Corn Cockle, Corn Rose, Corn Campion.

The seeds of this common plant are responsible for a great deal of trouble. Their reputation is so bad that

**Conditions of
Poisoning** certain of the United States have laws prohibiting the sale of feeds in which they are present even in the smallest proportion.

The plant grows commonly in wheat fields, and the seeds are of such a size that it is very difficult to separate them from the wheat. Before the days of modern machinery they often found their way into the flour with disastrous results. At present the chief trouble arises from the fact that when they have been cleaned from the wheat, they are mixed with bran and middlings or other feeds, sometimes in sufficient proportions to cause many deaths



Fig. 20.—Purple Cockle—*Agrostemma Githago*. Seeds five times natural size.

among animals. Cornevin, the distinguished French investigator, stated that the following amounts of the ground seeds are sufficient to cause death:

Calf	0.25 lb.	
Pig	0.10 "	per 100 lbs.
Dog	0.90 "	live weight.
Fowl	0.25 "	

Later investigators obtained different results, and it has since been found that the amount of poison in the seed varies for different seasons and different soils.

The toxic substance is saponin, of which the seeds contain up to 6.56 per cent. This same substance is also contained in other parts of the plant, but in such small quantities that no harm has arisen from its presence. It has an acrid taste but no odour, and is easily soluble in water, producing a solution which froths when shaken.

Githagism is the name given to a chronic poisoning caused by the taking of repeated small doses over a long period of time. The symptoms are a gradual loss of strength and wasting of flesh, accompanied by chronic diarrhœa and nerve troubles, ending in death. These symptoms are produced in human beings by the use of flour containing cockle. They are not found in lower animals with the exception of pigs.

The acute poisoning caused by large doses is described as follows by Chesnut: "Intense irritation of the digestive tract, vomiting, headache, nausea, vertigo, diarrhœa, hot skin, sharp pains in the spine, difficult locomotion, and depressed breathing. Coma is sometimes present and may be followed by death."

We quote from Long the symptoms which Cornevin observed in different animals: "In the *horse*, if a small quantity only is taken, there is yawning, heavy colic, stamping and evacuation of rather soft faeces. If larger quantities are taken, the symptoms, which commence in about an hour, are salivation, frequent yawning and turning of the head, colic, pale mucous membrane, hurried and weak pulse, rise in temperature and accelerated respiration. Some time later there are muscular tremors succeeded by pronounced rigidity, and the faeces are diarrhœic and fœtid. The animal lies down, and getting up is painful; it falls into a kind of coma, stretches itself to the utmost, and death takes place without convulsions.

"In *cattle*, the symptoms observed one hour after eating are restlessness, salivation, and grinding of the teeth. Excitement and colic are followed sometimes by coughing, this state lasting from five to eight hours. There is then a period of coma, characterized by permanent decubitus, repeated fœtid diarrhœa, hurried and plaintive respiration, accelerated and gradually weakening pulse, a gradual loss of motor and sensory powers, and a progressive decline in temperature. Death occurs in twenty-four hours.

"In the case of *pigs*, the animal grunts, lies down and remains thus with its snout embedded in the straw. There is vomiting, more or less violent colic and diarrhœa, the evacuation consisting of bad-smelling, spumous faecal matter. At times there are clonic contractions. Young pigs are most susceptible."

Pott cites cases in which abortion was a feature of the poisoning, both in cows and pigs.

The action of saponin is counteracted by extract of digitalis. Oils and demulcent drinks are also recommended.

The plant is common in the winter wheat fields of Europe and North America, and in the spring wheat of a few districts. It is about the height of the wheat plants. Its stems and narrow, pointed leaves are greyish green, owing to a scattered covering of fine, silky hairs. The rich, purple flowers, one to two inches across, with the five green, pointed sepals standing out beyond the petals, warrant the name *Agrostemma*, or "crown of the field."

The seeds are enclosed in a flask-shaped, one-celled capsule with a central column to which they are attached. When ripe the capsule opens at the top and the seeds break loose from their fastenings. They are jet black when ripe, from one-twelfth to one-eighth of an inch in diameter, and somewhat flattened. They are characterized by rows of teeth which curve round from a notch at the point of attachment. Fragments of the hulls are readily identified in ground feeds by these teeth.

COW COCKLE—*Saponaria Vaccaria* L.

Other Common Names: Cow Herb, China Cockle, Spring Cockle.

This plant is a close relative of Purple Cockle and was suspected of producing similar effects. Its growing prevalence in western grain fields led Chestnut and Wilcox to investigate the truth of these suspicions. Their experiments with rabbits corroborated the earlier statement that the plant contains a poisonous, saponin-like sub-

Effects Similar
to those of
Purple Cockle

stance, and established the fact that this poison is plentiful in the seed. A water extract of twenty-one grams of the seed, made a three-pound rabbit very ill, but it finally recovered. The residue from the water extraction was treated with 50% alcohol, and the solution from 1.5 grams of the seed, when injected into a thirty-two-ounce rabbit, caused death.

Symptoms and treatment follow the same lines as in the case of Purple Cockle. The use of the permanganate solution as described (p. 52) is recommended if the presence of seeds in the stomach at the time of treatment is suspected.

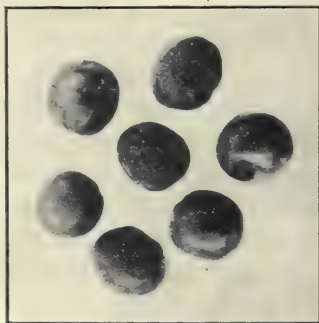


Fig. 21.—Seeds of Cow Cockle—*Saponaria Vaccaria*. Five times natural size.

The plant is an annual, introduced in grain from southern Europe, and thrives among the spring wheat of the west, where it is spreading rapidly. Its stem, simple or branching, is one to two and one-half feet tall, smooth, succulent and greyish green. The broadly lance-shaped leaves have no petioles, their base clasping the stem. The flowers are in flat-topped racemes, pale pink, and one-half inch across.

The Plant
and Seeds

The calyx is much inflated and five ribbed. The fruit capsules are smooth and similar to those of Purple Cockle but much more inflated, and contain about twenty seeds each.

The seeds are about one-twelfth of an inch across, round, hard and dull black. The surface is minutely roughened and there is a shallow groove down one side. On cutting the seed open the germ can be seen, curved about the outside of the starchy endosperm, just beneath the seed coat. When finely ground in feeds, it is only by careful microscopic examination that its presence can be determined.

MUSTARD FAMILY—*Cruciferae*.

WILD MUSTARD—*Brassica arvensis* (L.) Ktze., *Brassica Sinapistrum* Boiss.

Other Common Names: Charlock, Herrick.

The poisonous properties of this plant have been given less attention in America than they deserve. The reason is a natural one. The seeds only are harmful, and the plant is uncommon in hay and probably would be rejected if present. It thus happens that animals obtain the poison only when the seeds are combined with concentrated feeding stuffs. This very often happens, but the nature of the seed is such that when finely ground, an ordinary inspection fails to distinguish it from the wheat middlings with which it is often mixed, and so its harmful effects have been attributed to other causes.

A typical case of its action may be cited. A sample of shorts was received from a farmer, together with complaints that two of his pigs were already dead, and that the same would have been true of all the rest had he not discontinued the use of the feed. On casual examination, the sample appeared excellent. The microscope, however, revealed the presence of quantities of Mustard seed, very finely ground.* The seed, which must have been deliberately added to the

**A Case of
Poisoning**

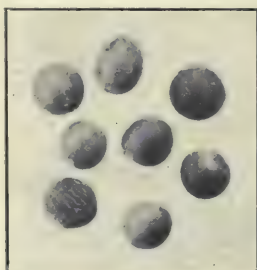


Fig. 22.—Seeds of Wild Mustard—*Brassica arvensis*. Five times natural size.

shorts, had served two purposes. In the first place it was a cheap adulterant, and secondly, it raised the fat and protein content of the feed as shown by chemical analysis.

A request for further information brought the following reply from the farmer: "The pigs came up to the trough and after feeding would fall back in a fit and kick about two minutes, then jump up and stagger a little. After wandering around the pen for a few days they died, eating little in the meantime. They showed agony when dying, kicking and frothing at the mouth."

*The complete separation of weed seeds is an essential preliminary to the milling of wheat, as otherwise a good grade of flour is not produced. Bran and shorts are therefore pure when they come from the mill.

Doubtless a trained observer would have detected other symptoms, but a comparison of those just stated with the typical symptoms of Wild Mustard poisoning will leave no doubt as to the cause of the trouble. According to Mueller, as quoted by Long, these are: "Inflammation of the stomach and intestines (with loss of appetite, wind, colic and diarrhœa) ; inflammation of kidneys (difficult, excessive or bloody urination) ; and nervous symptoms, with great exhaustion, uncertain gait, paralysis of limbs, and, in isolated cases, convulsions." Horses and cattle are affected to some extent, but pigs suffer most injury.

The poisonous constituents are three in number: volatile oil of mustard, the alkaloid sinapin, and the alkaloidal glucoside sinalbin.

The plant was introduced from Europe and has spread across the continent, in grain fields and waste places.

The Plant and Seed Although an annual it is a very bad weed on account of its numerous seeds. When buried in the soil they can live for many years. The plant is simple or branching, one to three feet high, with its upper leaves stemless, and the lower ones petioled and usually lobed. The stem is purple at its junction with the branches. The fragrant, bright yellow flowers, two-thirds of an inch in diameter, are in clusters at the tips of elongating racemes. The seed pods are slender and one to two inches long. They are knotted below and terminate in a two-edged beak.

The round, black seeds are about one-sixteenth of an inch in diameter, and slightly roughened. They resemble the seeds of some other Brassicas very closely, but can be distinguished from them by the microscopic and chemical characteristics of their coats. The epidermis

or colourless outer layer of the seed coat has each cell almost filled with vertical columns of mucilage grouped about a central cavity. Beneath, is the sub-epidermal layer and then the palisade cells, filled with a dark substance which turns red when warmed with concentrated solutions of hydrochloric acid and chloral hydrate in the proportion of one to twenty. Inside the palisade is an opaque, pigmented layer, while the centre of the seed contains oil and aleurone grains. It is here that the poison is located.

TUMBLING MUSTARD—*Sisymbrium altissimum* L.

Tumbling Mustard was introduced from Europe about 1887, and is an abundant weed in the grain fields of the west owing to its copious seed production and its efficient manner of spreading the seeds. When ripe the plant breaks off and is driven by the wind, and the seeds, of which it is reported that there may be as many as 1,500,000 on a single plant, are spread broadcast.

The whole plant is dangerous, owing to its pungent oils. According to Pammel deep ulcers may be produced by it.

Conditions of
Poisoning

The vegetative part is not palatable, but the seeds often find their way into feeds in quantity.

Tumbling Mustard is a branching plant, two to four feet high. The root leaves form a rosette, but later

The Plant
and Seeds

shrivel and disappear. The stem leaves are very varied and finely dissected. The flowers are pale yellow, about one-third of an inch

across, and the slender pods are two to four inches long. They are borne as in other Mustards. Introduced from Europe, the plant has spread over the continent and is a very troublesome weed in the north west.

The seeds are either olive brown or greenish yellow, slightly roughened, oblong, angular, and about one-twenty-fifth of an inch long. The radicle shows up prominently through the thin seed coat, the grooves on each side being darkened. The palisade cells of this seed, like those of Wild Mustard, form a cherry red compound with chloral hydrate and hydrochloric acid.



Fig. 23.—Seeds of Tumbling Mustard—*Sisymbrium altissimum*.
Five times natural size.

FIELD PENNYCRESS—*Thlaspi arvense* L.

Other Common Names: Frenchweed, Stinkweed.

The seeds of this plant are pungently bitter, and sickening to taste, owing to a peculiar oil. For this reason they are seldom eaten by pigs, on which such seeds have the strongest effects. Samples with accompanying complaints indicate that considerable quantities of shorts and bran have been made unfit for use as feed for pigs owing to the unpalatableness of the Field Pennycress seeds. If eaten, the plant and seeds have the same poisonous effect as the other plants of the mustard family. On some animals this effect is less apparent than on others. It would seem, for example, that rabbits can eat the seeds with

Effect of
Seeds in
Feed

impunity. This is also true of seeds like Wormseed Mustard, small quantities of which have proved fatal to pigs. Certain other animals are similarly immune. One farmer tells of a flock of geese which he fed on mill screenings containing a large percentage of Frenchweed seeds. The geese became very fat, and presented such a fine appearance that he planned to present a number of them to friends at Christmas. On preparing one of them for the table, however, it was found that the flavour of Frenchweed was so strong as to render the flesh unfit for food.

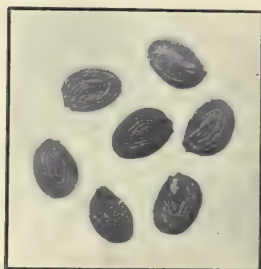


Fig. 24.—Seeds of Field Pennycress—*Thlaspi arvense*. Five times natural size.

Needless to say the original plan for the disposition of the flock was altered.

The plant, which is another introduction from Europe, has spread to the prairies, where it is a troublesome weed.

The Plant and Seeds It is an erect, smooth, light green plant. The radicle leaves are petioled and lance-shaped, while those on the stem are spear-shaped, with coarse teeth and a sagittate base. The clear white flowers are one-eighth of an inch in diameter and open, as in other mustards, in a flat cluster at the end of an elongating raceme. The flat seed pods are very characteristic.

owing to the broad wings which give them a total width of about one-half inch.

The flattened, dark brown seeds are about one-twelfth of an inch in diameter, with five or six deep, loop-like grooves arising from the notched place of attachment. They are pungently bitter.

WORMSEED MUSTARD—*Erysimum cheiranthoides* L.

This plant, like Wild Mustard, is harmful only when its seeds are included in ground feeds. The seeds, which



Fig. 25.—Seeds of Wormseed Mustard—*Erysimum cheiranthoides*.
Five times natural size.

contain a pungent oil, are intensely bitter, and unless an animal is very hungry, it will refuse feed containing any appreciable amount of them. One sample of shorts sent in for examination was accompanied by a statement that two neighbours had bought feed from the same lot. Each found all his pigs dead a few hours after the first feeding. An analysis showed a considerable proportion of Wormseed Mustard, there being 1.7% by weight of whole seeds present. This aroused suspicion, and feeding experiments made since by Dr. Hadwen, though not complete, have practically demonstrated the poisonous character of the seed.

The plant grows in grain fields and waste places throughout the country, but more plentifully east of Lake Superior. It is an erect plant six inches to two feet high, with dark green, lance-shaped, sparsely toothed leaves, and flowers one-fifth of an inch in diameter, in clusters an inch across at the tips of elongating racemes.

**The Plant
and Seed**

The slender seed pods are erect, on spreading stalks. They are one-half to one inch long, and four-angled. The small seeds, one-twenty-fourth of an inch long, are reddish yellow with the scar end darker. Their characteristic bitter taste as well as their microscopic structure afford a good means of identification.

WILD RADISH—*Raphanus Raphanistrum* L.

The effects of Wild Radish are very similar to those of Wild Mustard. Its acridity, according to Long, produces pronounced intestinal disorders.

The plant, like many others, is an introduced one. It is present in serious quantities only in the eastern provinces and states, but is found also in British Columbia and California. It grows one to two feet high, with a few widely spreading branches quite low on the stem. The pale, yellowish green leaves are deeply lobed and provided with a few stiff bristles. The flowers are fewer and larger than those of Wild Mustard and are conspicuously veined. The pods are swollen and jointed, with partitions between the seeds. When ripe, the pod breaks at the joints, and the seeds are shed, each enclosed in its own portion of pod.

The seed itself is about one-eighth of an inch long, oval, irregular, and slightly flattened. It may, however, vary greatly in size and shape. The finely netted surface is reddish brown in colour.



Fig. 26.—Seeds and broken pods of Wild Radish—*Raphanus Raphanistrum*. Five times natural size.

FLAX FAMILY—*Linaceae*.FLAX—*Linum usitatissimum* L.

This plant has been in cultivation from very ancient times. Its stems produce the fibre of linen, and its seeds are used for oil and feed. In western Canada where the plant is raised extensively for its seed, disastrous effects have come from the feeding of screenings containing immature flax bolls and frozen flowers.

J. R. Dymond, late of the Seed Branch, Ottawa, received a sample of flaxseed screenings with the following statement from a farmer in Saskatchewan: "A few weeks ago I fed about three gallons to a cow and two gallons to a heifer. Both were in convulsions in less than twenty minutes. The heifer died in about two hours, the cow in about eight hours." On analysis the sample was found to consist of: immature flax bolls and chaff, 75%; flaxseed, 18%; wheat, 4%; weed seeds, 2%. A chemical analysis showed a considerable proportion of prussic acid. Corroborative reports have come from other places where screenings containing immature flax bolls have been fed, and it is now an established fact that they develop prussic acid in sufficient quantity to make them dangerous in feeds.

The plant is too widely cultivated to need description here.

SECTION IV

Poisonous Plants which are Rarely Observed to Cause Death in Animals

Although this section consists of plants that have rarely been observed to cause the death of animals, and so may be thought of secondary importance to the veterinarian, farmer and stockman, yet animals may under exceptional circumstances be poisoned by them. Indeed, the aggregate loss from their agency is very considerable, and diagnosis should not be considered complete until this section has been consulted. Included among them are some of the most virulently poisonous of plants, e.g., the "Death Cup" mushroom, whose baneful effects on human beings are widely known. Others contain epidermal poisons so strong that death has been reported to have resulted from mere contact with the bruised plants. Still others are the source of medicinal drugs. On this account and because, as pointed out in the introduction, Section IV contains by far the larger proportion of the plants that are poisonous to human beings, this section should prove of especial interest to medical men.

FUNGI.

AMANITA spp.

The genus *Amanita* contains the most commonly known, as well as some of the most deadly of our poisonous mushrooms or "toadstools" as they are colloquially called. The top of the cap may have various colours, but

the gills are always white, or only very slightly tinged. The stem is bulbous at its base. While a few species of *Amanita* may be eaten with impunity, a large proportion are known to be deadly poisonous, and two in particular give trouble in Canada. It must be distinctly understood, however, that while we have limited our description to these two species of *Amanita*, there are many other poisonous forms, and no one should use as food any mushroom with which he is not familiar.

FLY AGARIC—*Amanita muscaria* (L.) Fr.

Other Common Names: Fly Amanita, Fly Fungus, Fly Killer.

This mushroom is not confined to the Western Hemisphere. It is native also to Europe and Asia where its name originated from the fact that it has for centuries been used as a poison for flies. Its natural place of growth is not in pastures but in woods. Nevertheless, records show that cattle are sometimes poisoned by it. In northeastern Asia the fungus is used in the manufacture of an intoxicating drink, notwithstanding the fact that many deaths result from over-indulgence.

The alkaloid muscarin is the chief poison which has been isolated. It acts on the nerve centres, producing the nervous symptoms. Bruce and Lond mention it as the only known substance which specifically contracts the pulmonary vessels. It is stated that .003 to .005 gram of muscarin is a very dangerous dose for a man. The amount present in the fungus varies greatly under different conditions. Moreover, a varying amount of the alkaloid pilz-atropin also contained in the mushroom neutralizes the muscarin to a greater or less extent. It is probably owing to the



Fig. 27.—Death Cup—*Amanita phalloides*. Fig. 28.—Fly Agaric—*Amanita muscaria*.

presence of this chemical in considerable quantities that in parts of France and Russia *Amanita muscaria* is used as food without harmful results. As ordinarily found in this country, however, the fungus has proved again and again to be deadly poisonous.

The poison is moderately rapid in its action, the symptoms usually, though not always, beginning within two hours after eating. The heart's action becomes slow and breathing is difficult. The nerves are so affected as to produce giddiness, cold sweat, and a deep stupor, which may last for hours or days. There may be no abdominal pain, and after the stupor has commenced the most powerful emetic often fails to produce vomiting. The patient may linger for two or three days before death ensues as a result of stoppage of the heart's action.

The following treatment is recommended by Chesnut: "The treatment for the Fly Amanita poison consists primarily in removing the undigested fungus from the alimentary canal, and in counteracting the effects of the muscarin upon the heart. The action of this organ should be fortified at once by hypodermic injections, by a physician, of some heart stimulant, preferably atropin, in doses of from 1-100 to 1-50 of a grain. As a stimulant emetic, mustard is particularly valuable. If this is not effective, apomorphin should be administered hypodermically by a physician; tannin is of little or no value in rendering the muscarin insoluble in the stomach. If vomiting has not taken place, recently burned charcoal may be administered for its mechanical effect in absorbing the poison, or a couple of grains of permanganate of potash in a 1 per cent alkaline solution to decompose it. The use of this substance should be fol-

lowed by oils or oleaginous purgatives, and the lower intestines should be washed out with an enema of warm water and turpentine. The use of atropin must be governed by the symptoms, but it is advisable to push it heroically, for in this alkaloid we have an almost complete physiological antidote to the poisonous principles of the Fly Amanita. Experiments on animals poisoned by this fungus and also by muscarin extracted from it have very clearly demonstrated that when the heart has nearly ceased to beat it may be stimulated almost instantly by a hypodermic injection of atropin. Its use, as thus demonstrated, has been the means of saving numerous lives. Muscarin may be dissolved out of the Fly Amanita to a great extent by vinegar, but the possible existence in the plant of such compounds as phallin (described under Death Cup, p. 114), makes its use extremely dangerous."

The Fly Agaric grows on the shady borders of fields and especially in coniferous forests, and is one of the largest of our mushrooms. The cap is yellow
The Plant to orange red, shining and warty, with a slightly striate margin. The gills are white. The stem, four to six inches long and about half an inch thick, terminates below in a scaly bulb.

DEATH CUP—*Amanita phalloides* (L.) Fr.

Other Common Names: Poison Amanita, Bulbous Amanita.

The name "Death Cup," with its sinister suggestion, has been well earned by this fungus, for it is responsible for even more deaths than its near relative, the Fly Agaric. The Death Cup, while sometimes coloured, is often pure white and very attractive in appearance. Its

taste is pleasant, and the victim has no warning of the trouble in store until, after some hours, the effects of the poison begin to be felt, often too late for remedy.

The principal poison is phallin, an extremely deadly member of the group called toxalbumens, which chemically resemble ordinary albumens such as white of egg. Like white of egg, phallin coagulates if boiled. If the Death Cup were prepared by soaking in salt water, in which the phallin is soluble, and thoroughly cooked it would produce no harm, but in too many cases where this toadstool is mistaken for a wholesome mushroom such precautions are not taken and fatal results follow.

Kobert studied the effect of phallin thoroughly in 1891. and discovered that the poison acts chiefly on the blood corpuscles, which are dissolved. The blood becomes unable to perform its functions, blood serum escapes into the intestine, and the vitality of the whole system is lowered until death results. The first effects do not appear until nine to twelve hours after eating, when abdominal pain begins, sometimes accompanied by cramps in the legs, convulsions and lockjaw resembling tetanus. Vomiting and diarrhoea follow, and these symptoms continue till death, which may not take place for from two to four days. "Rice water" stools as in the case of cholera, are said to be a characteristic symptom.

When the poisoning is discovered, care should be taken to remove all undigested parts of the toadstool from the stomach and intestine. There is no known antidote for phallin, but if the symptoms indicate the presence of muscarin-like substances the drugs used in case of poisoning by Fly Agaric should be administered. Blood transfusion with salt solution or with

healthy blood may in some cases be effective against the action of the phallin.

The fungus grows usually in woods, or along their borders. It is from three to six inches high, with a cap

The Plant. three to five inches broad, any colour from pure white to olive or brown. It is usually smooth, but has sometimes a few patches of membrane adhering to the top. The gills, spores, and stalk are white. The latter has a conspicuous ring beneath the cap, and its bulbous base is enclosed in a membranous cup, the "Death Cup." The bulb is buried deeply, and is often left behind in gathering the fungus. The stalk is hollow, or when young loosely filled with material suggestive of cotton fibre.

ARUM FAMILY—*Araceae*.

SKUNK CABBAGE—*Symplocarpus foetidus* (L.) Nutt.

Other Common Names: Polecat-weed, Swamp Cabbage.

The plant derives its common name from its strong odour. It is acrid and poisonous, "causing vomiting and temporary blindness" (Pammel). It is, however, avoided by animals.

The tough, thick, pointed, leaf-like spathe, pale green with purple blotches and streaks, is laid down in the fall, and in the early spring expands, disclosing the small purple flowers which are borne on a fleshy axis, called the spadix. This spadix enlarges, and the scarlet fruits are embedded in it. The enormous, short petioled leaves, with heart-shaped base, and short, ridged stem appear in later spring.

JACK-IN-THE-PULPIT—*Arisaema triphyllum* (L.) Schott.

Other Common Names: Indian or Wild Turnip, Three-leaved Arum.

The plant is acrid, especially its corm, which is very poisonous, having been used, according to Pammel, as insect poison. It is claimed that boiling or baking reduces the acidity. Animals do not eat it.

A native of North America, it is common in low, moist woods as far west as the prairies. The large pale-green spathe, streaked with brown or purple, arches over the spadix in the form of an old-fashioned pulpit. On the narrowed base of the spadix or "Jack" small flowers are borne, either staminate or pistillate as the case may be. The fruit is bright red. The leaves are compound of three smooth oval leaflets with entire margins.

LILY FAMILY—*Liliaceae*.

LILY OF THE VALLEY, *Convallaria majalis* L., is sometimes responsible for poisoning due to the presence of a very poisonous crystalline compound. It has an emetic and purgative action and a depressing effect on the heart. If sufficient quantities are eaten death results from paralysis of the heart.

Its two broad, entire leaves and spike of nodding, scented, white flowers are too well known to need special description.



Fig. 29.—Jack-in-the-Pulpit—*Arisaema triphyllum*.

IRIS FAMILY—*Iridaceae*.THE BLUE FLAG—*Iris versicolor* L.

Other Common Names: Wild Iris, Poison Flag, Water Flag, Fleur-de-lis.

The Blue Flag may cause trouble if its rootstock is eaten, as sometimes happens, in mistake for that of the Sweet Flag, *Acorus calamus* L. Violent vomiting, purging and burning, and congestion of the intestinal tract follow its ingestion.

The plant is erect, with thick, sword-shaped, bluish-green leaves and large flowers whose perianth of three large outer and three smaller, inner divisions is blue, changing to yellow towards the centre, and veined with purple. The pistil has three thin, petal-like stigmas, which arch closely over the stamens.

ORCHID FAMILY—*Orchidaceae*.THE LADY-SLIPPER—*Cypripedium* spp.

Other Common Names: Moccasin Flower, *Cypripedium*.

The Lady-slippers, since they are among the most beautiful and conspicuous of our native Orchids, are much sought after for decorative purposes.

As early as 1875 Dr. Babcock of Chicago came to the conclusion that annual attacks of skin-poisoning to which he was subject, were due, not, as he had supposed, to Poison Ivy, but to species of Lady-slipper. Since then his suspicion of the plant has been proved correct by other investigators. Dr. McDougal, in 1893, experimented with *Cypripedium hirsutum*, the Showy Lady-slipper,



Fig. 30.—Showy Lady-slipper—*Cypripedium hirsutum*.

and found that by brushing it over his arm he produced effects similar to those of Poison Ivy. In fourteen hours his whole arm and hand were much swollen and badly inflamed. The swelling did not go down for ten days, and effects were felt for a month.

The poison is in the form of a fatty acid, whose exact composition is not yet determined. It is contained in glandular hairs, which cover the surface of stem and leaves. The effect is strongest in the fruiting period. Even at this time, however, many more people are immune than in the case of Poison Ivy.

The *Cypripediums* are showy plants with brightly coloured flowers. There are three sepals, coloured like the petals. Two of these are usually united beneath a large, sac-like lip (the "slipper" or "moccasin") formed by one of the petals. The other petals stand out at the sides. There are three stamens, one of which is strap-like and sterile. The other two, one on each side, have two-celled anthers with masses of granular pollen. The leaves are many-nerved and plaited, with a sheathing base.

The following species are mentioned as poisonous:

The Smaller Yellow Lady-slipper, *Cypripedium parviflorum* Salisb., is a species widely distributed in swampy woods and bogs. Stem six to sixteen inches high; petals and sepals greenish, suffused with madder purple, one to one and a half inches long. Lip yellow with purplish spots or lines.

The Large Yellow Lady-slipper, *Cypripedium pubescens* Willd., somewhat larger and more hairy than the preceding, with a larger lip less strongly marked with purple; often growing in clusters in low woods or on moist prairie.

The Showy Lady-slipper, *Cypripedium hirsutum* Mill., stem one to two feet high, hirsute, usually in clumps; flowers pink; sepals rounded; lip oblong, much inflated, white marked with crimson; moist woods, Newfoundland to Manitoba and southward.

NETTLE FAMILY—*Urticaceae*.

THE STINGING NETTLE, *Urtica dioica* L., is one of a well known group whose stinging hairs secrete a poison that causes burning and itching inflammation of the skin. It is found from the Atlantic to the prairies. It is an erect plant with thin, ovate, toothed, sharp-pointed leaves, cordate at the base, and with long petioles. The flowers, in large clusters, are either staminate or pistillate. The stem and leaves are provided with stinging hairs.

THE SLENDER NETTLE, *Urtica gracilis* Ait., produces the same effect. It is from two to seven feet high and rarely branched. The leaves are more slender than in *Urtica dioica* and are not cordate at the base. THE WESTERN NETTLE, *Urtica Lyallii* Wats., THE SMALLEST STINGING NETTLE, *Urtica urens* L., and THE WOOD NETTLE, *Laportea canadensis* (L.) Gaud., produce similar results.

The juice of the Jewel Weed, *Impatiens biflora* Walt. gives relief from the inflammation caused by Nettles. The plant is three feet or more tall, grows plentifully in moist places, and is easily recognized by its translucently yellowish-green stem and sac-like, pendent, orange flowers spotted with brown. Relief is obtained by rubbing the crushed stem on the inflamed area, sometimes an enormous reduction of swelling following its application.



Fig. 31.—Slender Nettle—*Urtica gracilis*.

POKEWEED FAMILY—*Phytolaccaceae*.POKEWEED—*Phytolacca decandra* L.

Other Common Names: Scocke, Poison Poke, Pigeonberry, Garget.

The roots and fruit of this weed are used in medicine for skin diseases and rheumatism. In some parts of the country its young shoots are highly esteemed as a substitute for Asparagus. The roots are carefully removed in such cases on account of their bitter taste. On boiling, the drug, which is present in all parts of the plant, is extracted, and the greens are quite wholesome provided the first water in which they are boiled is poured off.

The root has been mistaken for that of the Parsnip, Artichoke, or Horse Radish, and human poisoning has resulted mostly from such mistakes, or from overdoses when used as medicine. In a few cases the death of children has been attributed to the eating of the fruit and seeds. Where the plant grows abundantly, the young shoots have caused the death of cattle.

Phytolaccin, an acrid alkaloid, has been isolated from Pokeweed, as have also the poison phytolaccotoxin, phytolaccic acid, saponin and a glucoside. The weed produces vomiting, its action in this regard being very slow. The vomiting begins only after about two hours and is accompanied by violent retching. Severe purging is also produced, along with spasms, and sometimes convulsions. Death, when it occurs, is caused by paralysis of the respiratory organs, due to the narcotic action of the plant poison.

Pokeweed is a smooth, coarse perennial, growing from four to nine feet high, and found on low, rich ground in Ontario and the states to the southward. Its root, the



Fig. 32.—Pokeweed—*Phytolacca decandra*.

most poisonous part, is large and dull yellow in colour. In old plants each branch of the root may be two or three inches thick. The leaves are large, smooth, petioled and pointed at both ends. The venation is pinnate, and each main vein forms a loop near the edge of the leaf, uniting it with its neighbour. Bright green in summer, the leaves turn red in autumn. The inconspicuous flowers are borne in terminal and lateral racemes. They have no petals, but the sepals are white. The green ovary soon becomes prominent. In autumn the calyx turns bright red and the berries become deep purple, with red juice. The seeds, arranged in a circle in the berry, are black and polished.

PINK FAMILY—*Caryophyllaceae*.

BOUNCING BET, *Saponaria officinalis* L., also known as Soapwort, is poisonous, the whole plant and especially the root containing saponin, the effects of which are explained in the section dealing with Purple Cockle (p. 96). The plant is found in old gardens and has often escaped from them to roadsides and other waste places. It is a coarse perennial with showy bunches of white to pinkish flowers.

BUTTERCUP FAMILY—*Ranunculaceae*.

THE WHITE BANEERRY, *Actaea alba* (L.) Mill., is known by various common names, Doll's Eyes, Coral and Pearls, White Beads, Necklace-weed. This plant causes trouble chiefly to children who are attracted by the berries. It is found in rich woods as far west as Ontario and Minnesota, and at fruiting time is known by its oval white berries in an oblong cluster, each berry being sup-

ported by a thick, red peduncle. The leaves are large and compound, with thin, notched leaflets, and the white flowers are very small.

THE RED BANEERRY, *Actaea rubra* (Ait.) Willd., resembles the white species but its leaves are less delicate and more coarsely toothed. The bright red berries are borne on peduncles which do not become thickened. There is a variety with white berries, but it can be distinguished from *Actaea alba* by the slender peduncles.

Its poisonous action is similar to that of the preceding.

THE CURSED CROWFOOT—*Ranunculus sceleratus* L.

Other Common Names: Biting Crowfoot, Celery-leaved Crowfoot, Blisterwort.

This plant is the most poisonous member of the genus *Ranunculus*. Its juice has an extremely acrid, volatile constituent, strong enough, it is said, to produce a blister if placed in contact with the skin for two minutes. In Europe, professional beggars used the plant for producing sores and ulcers, to excite pity and obtain gifts. The plant is found in low lands throughout the continent, but, needless to say, is seldom eaten. It has, however, been held responsible for much trouble, especially in cows, producing, according to Cornevin, colic and diarrhoea with attempts at vomiting, accompanied by a falling off in milk and various nervous symptoms. In serious cases convulsions are produced, followed by death in six to twelve hours. Similar symptoms are produced in horses. Willing says that treatment should be symptomatic, and that tannin is advisable.



Fig. 33.—Cursed Crowfoot—*Ranunculus sceleratus*.

The plant, which blooms from June to August, is an annual, one-half to two feet high. The thickish leaves are three-lobed and toothed, the radical with long petioles and those of the stem sessile or with shorter stalks. The flower is typical of the family, with five sepals, five petals of equal length, and numerous stamens and pistils, the latter forming an oblong head when ripe. The flower is about one quarter of an inch broad, and pale yellow.

THE COMMON OR TALL BUTTERCUP, *Ranunculus acris* L., is plentiful in pastures east of the prairies and is found also in British Columbia. Its effects resemble those of *Ranunculus sceleratus* but are not nearly so pronounced. Animals avoid it, but naturally, in pastures where it is plentiful, small amounts are sometimes eaten, and in such cases it has been blamed for causing sporadic abortion in cows. As in all other members of the genus, the poison is volatile, and when dried in hay the plants are harmless.

The Tall Buttercup is a perennial, somewhat hairy plant, two to three feet in height and conspicuous on account of the abundant bright yellow flowers sometimes an inch in diameter. The sepals are small, pointed, and hidden by the spreading, rounded petals. The leaves are three to seven-parted, and deeply lobed. The root leaves are larger and more lobed than the stem leaves, and are provided with long petioles.

THE SMALL FLOWERED CROWFOOT, *Ranunculus abortivus* L., is acrid, and causes blistering. It is a smooth plant one-half to two feet high. Its root leaves are petioled, round, heart-shaped or kidney-form and cre-

nately lobed, and the stem leaves sessile or nearly so, with linear lobes. The flowers are very small, the yellow petals being no longer than the reflexed sepals. It has a fruiting head like that of *Ranunculus sceleratus* but smaller.

MARSH MARIGOLD—*Caltha palustris* L.

Other Common Names: Cowslip, Soldiers-buttons.

As a general rule animals may be trusted to avoid the Marsh Marigold on account of its acrid properties. Cases have occurred, however, of poisoning among both cattle and horses, sometimes with fatal results. The young plants are harmless, becoming toxic about the time of flowering. The symptoms resemble those produced by Buttercups. When dried in hay the plant is harmless.

Though it is an eastern species, the plant is found in moist or swampy situations as far west as Saskatchewan. It is a somewhat fleshy perennial with hollow, grooved stems, growing in clumps with abundance of large, bright yellow flowers. The sepals are coloured but no true petals are present. There are numerous stamens and ten pistils developing flattened seed pods. The leaves are rounded, with a smooth or crenate margin. The flowers are found in early spring, but may continue until June.

Caltha asarifolia DC., *Caltha leptosepala* DC., *Caltha biflora* DC. and *Caltha chelidonii* Greene, are western forms with similar acrid properties and grow in marshy places among the mountains. The first named species has yellow flowers, while the rest have white.

BARBERRY FAMILY—*Berberidaceae*.THE MAY APPLE—*Podophyllum peltatum* L.

Other Common Names: Mandrake, Umbrella-plant, Devil's Apple, Vegetable Calomel, Wild or Ground Lemon.

This plant contains podophyllin, a bitter resinous substance used in medicine as a purgative, over-doses of which have proved fatal. It is very bitter when fresh and so produces few cases of poisoning, although it is very plentiful. The ripe fruit contains very little if any of the drug. It has a sweetish, slightly acid taste and makes a delicious preserve.

A native of North America, the plant grows plentifully in parts of Quebec and Ontario and south to Florida and Texas, in open woods and the shaded parts of pastures. The underground rootstock is perennial and from it arises the erect stem, a foot or so in height. From the top are given off two fleshy petioles, bearing large umbrella-shaped leaves, deeply lobed and notched. The pearly white flower grows from the fork. The ovoid fruit is from one to two inches long and turns yellow when ripe.

POPPY FAMILY—*Papaveraceae*.

THE BLOODROOT, *Sanguinaria canadensis* L., is another native drug plant, containing sanguinarin which in small doses is a tonic, but in larger quantities exerts a severe irritant effect, with nausea and burning sensations in the mucous membranes, followed by vertigo and insensibility. In the natural state it is not eaten, for the taste is exceedingly acrid, and the orange red juice is repulsive.

It is among the earliest of our spring flowers and is found in rich woods of the eastern half of the continent. The heavily-veined and lobed leaf is at first folded about the flower bud, showing only its greyish-green, under surface. The two sepals fall off as the flower opens, and the eight white petals soon follow. The shining brown seeds are contained in slender green pods. The thick, red perennial rootstock is rich in alkaloids.

THE GREATER CELANDINE, *Chelidonium majus* L., has effects that are similar to those of Bloodroot. It also is rarely or never eaten by stock.

It is a brittle plant, one to two feet tall, with deeply lobed leaves and small yellow flowers. The two sepals fall off when the flower opens, leaving four yellow petals. The juice is deep yellow, turning red on exposure to air.

PEA FAMILY—*Leguminosae*.

THE PRAIRIE THERMOPSIS, *Thermopsis rhombifolia* Richards, is often eaten by sheep and has in some cases been thought to have poisoned them. The seeds are supposed to be the poisonous part, and several reports have come from western Canada of children being poisoned by eating them. They rarely cause death.

The plant is an erect perennial resembling the Lupines to some extent. It is covered with silky hairs and grows from Manitoba and Kansas to the mountains. The leaves have broad stipules and three obovate leaflets. The short racemes bear a few yellow flowers and recurved pods.

THE SCOTCH BROOM, *Cytisus scoparius* (L.) Link., has been introduced and is found along the Atlantic and Pacific coasts. It contains cytisin, and sometimes poisons stock, causing salivation, vomiting, staggering and paralysis. The lower leaves are compound, with three obovate, spiny-tipped leaflets, while the upper ones are sessile and often entire. The yellow flowers are borne in long, leafy racemes.

THE BLACK LOCUST, *Robinia Pseudo-Acacia* L., is a tree common in cultivation, the leaves, bark, roots and seeds of which are poisonous, containing an albuminous substance resembling belladonna in its action. Cases of poisoning are comparatively rare, though they have been reported for animals and for people as well. In one case thirty-two boys were poisoned by eating the bark stripped from fence posts. No deaths occurred however.

In cases of human poisoning fever is followed by paleness and coldness of the extremities. There is vomiting. The pupil is dilated and the heart-beat weak and intermittent. The treatment which was administered in the case of the boys mentioned above consisted of "sinapisms over the stomach, sub-carbonate of bismuth, camphor and brandy." (Pammel).

THE CLAMMY LOCUST, *Robinia viscosa* Vent., has similar poisonous properties. It is a small tree with glandular twigs, petioles and peduncles. The leaves have more leaflets than those of the Black Locust, varying from eleven to twenty-five. The flowers are pinkish and odourless, in dense racemes.



Fig. 34.—Clammy Locust—*Robinia viscosa*.

SPURGE FAMILY—*Euphorbiaceae*.

THE CASTOR OIL PLANT, *Ricinus communis* L., contains in its seeds the poison ricin, which remains in the cake after the castor oil has been pressed out. These seeds are stated to have caused death in man, and Chesnut says they have killed horses when eaten accidentally, and that sheep have been poisoned with them. "They cause vomiting, gastric pain, bloody diarrhœa and dullness of vision." (Pammel). An antitoxin has been discovered, after the use of which animals may be fed on the castor bean cake without injury.

The plant is ornamental, and is often cultivated. It is a smooth, branching annual, five feet or more in height, with large, palmately lobed leaves. The large mottled seeds are enclosed in the somewhat spiny case.

SUMAC FAMILY—*Anacardiaceae*.POISON IVY—*Rhus Toxicodendron* L.

Other Common Names: Poison-oak, Poison-vine, Three-leaved Ivy.

This plant is a native of eastern North America and extends west to Alberta. It is notorious for its extremely irritating effect on the skin. It contains a non-volatile oil, toxicodendrol, which, when brought into contact with the skin of a susceptible person, causes inflammation and swelling, accompanied by intense irritation, and followed by vesicles or blisters. The skin breaks and a liquid exudes which, on drying, forms crusts or scabs. Pammel quotes two reports of death from severe Ivy poisoning in the case of children.

The action is slow, characteristic symptoms appearing only after a lapse of eighteen hours or more. Some people

are not susceptible and can handle the plant without harm. It is believed by many that those on whom the poison is effective may even be poisoned without handling it, from hairs and pollen grains or even from the smoke of its burning. McNair's recent investigations of *Rhus diversiloba* Torr. and Gray, which is so nearly like *Rhus Toxicodendron* that many botanists consider the two identical, have led him to the conclusion that this belief is erroneous. He finds that the poison is contained in ducts in the bast or inner bark of the plant and that the wood, pollen, hairs, and the corky layers of the bark are harmless. It is probably the fact that the poison is a non-volatile oil that has led to so much of the popular confusion with regard to its dissemination. By unwitting trampling among the plants the poison is deposited on boots or clothing, whence it would become a centre of future distribution.

The oil has no effect on the skin of the most of the lower animals, and it is stated that almost all domesticated animals can eat it with impunity. Dogs, however, are poisoned by it.

Treatment* consists in the removal of the poison from the skin by solution or by decomposing it chemically. Scrubbing with soap and water is recommended and produces good results. It should be done before the poison has had time to sink deeply into the skin. Alcohol will dissolve the oil, and washing with a 50% solution is effective. It is stated that lead acetate neutralizes the irritating substance. A saturated solution of this salt in 50% alcohol has been proved most effective.

* In a publication received since going to press, Güssow reports uniformly good results from applications of tincture of iodine, each followed after twenty-four hours by washing with soap and water (Can. Field Nat., vol. XXXV No. 6).



Fig. 35.—Poison Ivy—*Rhus Toxicodendron*. Summer and winter condition.

The plant is a perennial shrub, sometimes low and erect and sometimes trailing or climbing by aerial root-lets. The leaves are petioled, and pinnately compound, with three irregularly ovate leaflets, variously notched and toothed. Scarcely two leaves on the same or different plants can be found alike, and this proves a most valuable means for identification. The inconspicuous flowers grow in loose panicles in the axils of the leaves. The fruit is whitish and globular, with a waxy appearance.

Whenever practicable, Poison Ivy should be eradicated. Where possible it is best to plow the land where it grows and crop it until the ivy is killed. For places where this cannot be done, Stone recommends a solution of one-half to one pound of arsenate of soda dissolved in five gallons of water. This should be applied in sufficient quantity to soak into the soil and reach the roots. Five gallons is sufficient to treat three to five square rods.

WESTERN POISON IVY OR POISON OAK, *Rhus Rydbergi* Small, a low shrub growing in the Rocky Mountain region, has the same effect as *Rhus Toxicodendron*. Unlike the latter, it does not creep or climb, but always stands erect, one to two feet high. The three leaflets are often tinged with purple when young. The small, greenish flowers are borne as in the eastern Poison Ivy, and the shiny white fruit is similar.

POISON OR SWAMP SUMAC, *Rhus Vernix* L., is a shrub or small tree sometimes attaining a height of twenty-five feet. It is found in the eastern and central United States and in Ontario, and produces effects similar to those of Poison Ivy. The leaves are petioled and pinnately com-

pound, with one to thirteen entire leaflets, obovate, oval, or the lowest ovate, with short stalks and acuminate points. The small, green flowers are in loose panicles in the axils of the leaves. The fruit is greyish in colour and slightly oblong. The leaves are very brightly coloured in autumn.

HEATH FAMILY—*Ericaceae*.

THE FETTER-BUSH, *Andromeda polifolia* L., contains andromedodextrin, a narcotic poison, in its leaves. Pammel states that it has been known to poison sheep. It is a shrub six inches to two feet high, growing in bogs throughout the country. Its small, oblong, leathery leaves have strongly revolute margins, and are white woolly beneath. The drooping umbels each contain only a few delicately coloured pink flowers.

LEATHERWOOD FAMILY—*Thymelaceae*.

THE SPURGE LAUREL, *Daphne Mezereum* L., is known by a variety of other common names, viz., Mezereon, Lady-laurel, Paradise Plant, Mystery Plant and Dwarf Bay, and contains several poisonous substances. Its bark, leaves and fruit are poison when taken internally, producing burning, vomiting, giddiness and convulsions. Fresh bark soaked in water produces blisters when applied to the skin.

It is a small shrub with oblong, lanceolate leaves, fragrant, rose-purple flowers, and red drupes.

THE LEATHERWOOD, *Dirca palustris* L., known locally as Moosewood, Wicopy, Swampwood, and Rope-bark, produces effects similar to those of *Daphne*. It is a shrub with yellowish-green branches and oval leaves, two or

three inches long. The flowers, blooming in April, are pale yellow and tubular, with the style protruding beyond the stamens.

POTATO FAMILY—*Solanaceae*.

BITTERSWEET, *Solanum Dulcamara* L., other common names of which are, Woody Nightshade, Bittersweet-nightshade, and Scarlet Berry, is a poisonous plant containing solanin and dulcamarin, the latter of which gives the berries their peculiar taste, sweetish at first, but later bitter. Solanidin and solanein are also present. The berries and leaves are poison, but only mildly so, considerable quantities being required to produce the characteristic narcotic effects.

It is a straggling or climbing perennial, with peculiar, irregular, halberd-shaped leaves and cymose clusters of purple flowers shaped somewhat like those of the potato, with prominent yellow stamens. The berries are round or slightly oval, and of an attractive, bright red colour. The plant grows from the Atlantic to Ontario and southward, and is quite readily recognized by its peculiarly shaped leaves.

THE COMMON NIGHTSHADE, *Solanum nigrum* L., also known as Black, Deadly, or Garden Nightshade, contains solanin and solanidin. The berries are used as food to some extent, but should be eaten with caution. They are probably more poisonous when not completely ripe. Some plants contain more poison than others, the amount varying with varying conditions of climate and soil. In cases of poisoning reported to have been caused both by berries and by leaves, the symptoms are staggering, loss of feel-



Fig. 36.—Bittersweet—*Solanum Dulcamara*.



Fig. 37.—Common Nightshade—*Solanum nigrum*.

ing, and cramps. In the rare instances where death occurred, it came as a result of paralysis of the lungs.

The plant grows across the continent in shaded places. It is a rather spreading annual with ovate, sinuately-lobed leaves. The flowers resemble those of Bittersweet but are white instead of purple. The berries are black.

THE THREE-FLOWERED, SPREADING OR PRAIRIE NIGHTSHADE, *Solanum triflorum* Nutt., has berries which have been proved poisonous in experiments with guinea pigs. It grows on plains in Ontario and the west, and is a low, spreading annual with acute, pinnately dissected leaves. The flowers, in clusters of one to three, are white; the berries, green or blackish.

THE BLACK HENBANE, *Hyoscyamus niger* L., other common names of which are, Foetid Nightshade, Insane Root, and Poison-tobacco, contains a very poisonous mixture of alkaloids; the chief of which are hyoscyamin and hyoscin. Pseudohyoscyamin is also present. The roots and seeds are more poisonous than the leaves. The taste is disagreeable and animals usually do not eat it. Many cases of children poisoned by the seed are on record. The effect of the drug is similar to that of atropin, but its action on the brain is more sedative and its stimulation of heart and respiratory centres is less pronounced. It is used in medicine.

The plant is found in Canada and the northern states extending as far west as Ontario. It is erect and one to three or four feet high. The leaves are ovate and sinuate toothed, the upper ones clasping the stem. The flowers are in one-sided leafy spikes. The bell-shaped or cup-shaped corolla is composed of five united, dull yellow



Fig. 38.—Black Henbane—*Hyoscyamus niger*.

petals with purple veins, and the seed capsule is globose-oblong. The whole plant is covered with a thick mat of clammy hairs, especially the leaves, branches and flowers.

THE THORN APPLE—*Datura Stramonium* L.

Other Common Names: Jimson Weed, Jamestown Weed, Stramonium, Devil's Apple, Mad Apple, Stinkwort.

This plant is very poisonous in all its parts. There are a few cases of animal poisoning from its young leaves, but it is usually avoided. Children have repeatedly been poisoned by eating the seeds, in many cases so severely as to cause death. The plant contains atropin and hyoscyamin as well as other drugs. The symptoms of poisoning are: headache, nausea, vertigo, extreme thirst, dry, burning skin and general nervous confusion, with dilated pupils, loss of sight and of voluntary motion, and sometimes mania, convulsions and death.

The treatment is to empty the stomach by means of stomach tube or emetics, wash it out with tannic acid, strong tea, or an infusion of oak bark, and administer stimulants.

The plant grows on waste ground throughout the country. It is from two to five feet high with smooth stems and sinuately lobed leaves with the lobes taper-pointed. The large, white flowers two inches or more in length, are tubular, with five lobes at the apex. The seeds are contained in ovoid capsules one to one and a half inches long, usually covered with spines, and splitting into four parts when ripe. The whole plant has a pronounced sickening odour.



Fig. 39.—Jimson Weed—*Datura Stramonium*.

THE PURPLE THORN APPLE, *Datura Tatula* L., has similar effects to those of *Datura Stramonium*. It may be distinguished from it by its purple stems and pale purple flowers.

THE TOBACCO PLANT, *Nicotiana tabacum* L., contains the alkaloid nicotin whose action has been much discussed. Dry leaves of the tobacco plant contain 6% of the alkaloid, which is a very powerful and rapid poison. Dr. Winslow summarizes the symptoms caused by swallowing nicotin and the proper treatment in such a case. First there is irritation and pain in the throat and stomach. Then comes trembling and weakness, followed by convulsions, which later cease. The pupils are contracted. Then vomiting and purging and increased urination are produced. Respiration is at first slow, then rapid.

The proper treatment is to empty the stomach and use tannic acid and heart stimulants such as strychnin, atropin or alcohol.

Nicotin cannot be held directly responsible for all the effects due to smoking, as it is easily decomposed by heat into pyridin and other similar alkaloids. Pyridin, in large doses, causes depression of the spinal nerves and paralysis of respiration.

The plant is from four to six feet high, with very large ovate lanceolate leaves and panicles of rose-purple flowers with a funnel-form corolla two inches long. It is a native of South America.

WILD TOBACCO, *Nicotiana rustica* L., is found in Ontario and southward, and was cultivated by the Indians. Its effects are similar to those of common tobacco. It is an annual, with ovate leaves and greenish-yellow flowers.

FIGWORT FAMILY—*Scrophulariaceae*.

THE PURPLE FOXGLOVE, *Digitalis purpurea* L., contains a number of poisonous alkaloids, and is used in medicine, chiefly as a heart stimulant. An overdose, or a succession of full medicinal ones, will cause the heart to lose force and become irregular. When death results it is from failure of the circulation.

Treatment consists of the use of emetics and purgatives along with tannic acid and alcohol or opium.

The Foxglove is a European plant. It was introduced into this country for decorative purposes, and has escaped from gardens in some localities, especially along the western coast. It is a tall, pubescent, stout-stemmed biennial herb with alternate leaves, the lower ones petioled and ovate lanceolate and the upper sessile and smaller. The drooping flowers are irregular, purple and spotted, and are borne in long racemes. The corolla is tubular, and the name *digitalis* comes from its fancied resemblance to the finger of a glove.

LOBELIA FAMILY—*Lobeliaceae*.

THE INDIAN TOBACCO, *Lobelia inflata* L., known also as Wild Tobacco, Asthma-weed, Gad-root and Lobelia, is used in medicine for asthma and similar diseases. Its effects are similar to those caused by somewhat smaller amounts of tobacco. Overdoses produce prostration, stupor, coma, convulsions, and death.

It grows in fields as far west as Saskatchewan, and is an erect, branching, hairy annual. The leaves are toothed, the upper ones being very small and bract-like. The small blue flowers have an ovoid calyx-tube inflated in



Fig. 40.—Indian Tobacco—*Lobelia inflata*.

fruit. The corolla is irregular, as in all members of the genus *Lobelia*, the upper lip being two lobed, and the lower spreading and three-cleft.

SUNFLOWER FAMILY—*Compositae*.

TANSY, *Tanacetum vulgare* L., contains a violent, irritant, narcotic poison, producing spasms and convulsions, but is very rarely eaten by animals. It was introduced into this country from Europe, and has escaped from gardens in various places.

It is a bitter and strong-scented herb, two to four feet high, with tough parsley-like leaves. The heads, each containing many yellow, tubular florets and few ray florets, are borne in dense flat corymbs.

Symptoms Key to the Principal Poisonous Plants

A botanical key, based on the flower structure and morphological features of plants, has proved invaluable to botanists. The value of such a key depends on the ease and definiteness with which the name of a plant can be ascertained by its use. Such definiteness cannot be claimed for the work which follows. It is, in the first place, quite conceivable that any of the symptoms named might be caused by something other than the eating of a poisonous plant. Even if a plant has caused the trouble, it is often impossible, judging by symptoms alone, to decide definitely what particular species is responsible. It therefore follows that the worker with poisonous species must know his plants, as the botanist knows them, by a knowledge of and familiarity with their distinctive characteristics.

This key is included, however, so that when an animal exhibits symptoms of poisoning and a plant is suspected, an idea may be rapidly gained of the plant that should be looked for in pasture or feed. To make a complete diagnosis the plant must always be found and carefully identified.

I. Injurious in Hay or Coarse Feeds.

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GLOSSARY

- Abortion.* Premature birth.
- Acaulescent.* Stemless.
- Acridity.* Sharp, bitter taste.
- Acuminate.* Taper-pointed.
- Aleurone.* The protein layer of a seed.
- Alternate.* One after another (used of the arrangement of leaves on a stem).
- Anaërobic.* A term applied to organisms which thrive best when air is excluded.
- Anæsthesia.* Loss of feeling.
- Annual.* Maturing in one year.
- Anther.* The pollen-sac of a stamen.
- Antidote.* A substance which counteracts a poison.
- Antiferment.* A preventative of fermentation.
- Antitoxin.* An antidote for a toxin.
- Arterioles.* Fine, elastic-walled blood vessels connecting arteries and capillaries.
- Arthropods.* Animals with jointed limbs like the insects, spiders, etc.
- Ascomycete.* A fungus which bears its spores in asci.
- Ascus (Pl. asci).* A spore sac.
- Asphyxia.* Suffocation.
- Ataxia.* Inability to coördinate voluntary movements.
- Atrophy.* Degeneration.
- Autopsy.* An examination after death.
- Awns.* "Beards", as in barley.
- Axil.* The angle between leaf and stem.
- Bacillus.* A rod-shaped type of bacterium.
- Biennial.* Maturing in two years.
- Botulism.* A disease produced by a bacillus living in spoiled meats, etc.
- Bracts.* Small abortive leaves.
- Calyx.* The outer whorl of a complete flower, composed of sepals, usually green.
- Capillary.* A fine, thin-walled bloodvessel, where gaseous, food and other exchange takes place.
- Capsule.* A short pod.
- Cardiac.* Relating to the heart.

- Carpel.* A division of the pistil, composed of one stigma, one style and one ovary.
- Cerebral.* Relating to the brain.
- Clonic.* With alternate convulsive contractions and relaxations of the muscles.
- Coma.* Stupor.
- Congestion.* Over supply of blood.
- Conidium* (Pl. *conidia*). Spore cut off from the end of a hypha of a fungus.
- Conjunctiva.* The membrane covering the free surface of the ball of the eye and the inner surface of the eyelid.
- Cordate.* Heart-shaped.
- Corm.* The base of a stem enlarged for food storage.
- Corolla.* The second whorl of a complete flower, composed of petals, usually coloured.
- Corymb.* A raceme which is broad and flat, or only slightly convex, the lower pedicels being lengthened.
- Corymbose.* Resembling a corymb.
- Crenate.* With rounded lobes.
- Cumulative.* Increasing by successive additions.
- Cyme.* A usually broad flower cluster with the terminal flowers oldest.
- Cymose.* Resembling a cyme.
- Decompound.* Several times compound.
- Decubitus.* Recumbent posture.
- Deliriant.* Causing frenzy.
- Demulcent.* Soothing.
- Dissected.* Cut into fine divisions.
- Diuretic.* A stimulant to the secretion of urine.
- Drupe.* A stone-fruit (e.g., the plum).
- Dysentery.* A disease of the large intestine characterized by fever, pain and bloody discharges.
- Ellipsoid.* Resembling an ellipse.
- Emetic.* Anything which produces vomiting.
- Endosperm.* Food material of a seed outside the germ.
- Enema.* An intestinal injection.
- Enteritis.* Inflammation of the intestines.
- Enzyme.* A ferment.
- Faecal.* Relating to the faeces.
- Faeces.* Excretion of the bowels.
- Filament.* The stalk of a stamen.
- Floret.* One of the flowers of the head in the Sunflower Family.

- Fron*d. The vegetative or fruiting leaf of a fern.
- Fungus*. A member of one of the low groups of plants, without chlorophyll, (e.g., mushrooms, moulds, etc.).
- Gangrene*. Death of the body tissues in local areas, leading to decomposition.
- Genus*. A group of similar, or related species.
- Glaucous*. Covered with "bloom", as in the plum.
- Glandular*. Producing a secretion.
- Hirsute*. With stiff hairs.
- Hypha*. A fungus filament.
- Lanceolate*. Lance-shaped.
- Ligule*. An appendage where the leaf blade joins the sheath in such leaves as those of the grasses.
- Linear*. Long and very narrow.
- Lyrate*. Lyre-shaped (e.g., radish leaves).
- Middlings*. Feed composed of the inner coats of grain.
- Morphology*. Gross form or structure.
- Oblanceolate*. Lance-shaped with the point nearest the stem.
- Oblong*. Several times longer than broad and with nearly parallel edges.
- Oesophagus*. Gullet.
- Oleaginous*. Oily.
- Orbicular*. Round or nearly round.
- Ovary*. The part of the pistil which contains the egg cells and later the seeds.
- Ovate*. Oval with the base broader.
- Ovoid*. Somewhat ovate.
- Palmate*. Radiating from one point.
- Panicle*. A branching raceme.
- Paraplegia*. Paralysis of the legs and lower part of the body.
- Parasite*. An organism subsisting on the living bodies of plants or animals.
- Pathological*. Relating to disease.
- Peduncle*. Flower stalk.
- Peltate*. Umbrella-shaped, having a central stalk.
- Pendent*. Hanging.
- Perennial*. Living for more than two years.
- Perianth*. The floral envelope of certain flowers.
- Petal*. One of the divisions of the corolla.
- Petiole*. Leaf-stalk.
- Pinnate*. Like a feather, with veins or leaflets extending from the sides of a midrib.
- Pistil*. The whole seed-bearing part of a flower.

- Pistillate.* Pertaining to the pistil.
- Polymerized.* Changed into another substance, having the same atomic proportions but a higher molecular weight.
- Pubescent.* Soft hairy.
- Pulmonary.* Relating to the lungs.
- Pyloric.* Relating to the pylorus, the opening from stomach to intestine.
- Raceme.* A flower cluster resembling a spike but with the flowers stalked.
- Rachis.* The central axis of a spike or of a compound leaf.
- Radicle.* The part of the seed that develops into the root.
- Revolute.* In-rolled.
- Reflexed.* Bent back.
- Regurgitation.* Expulsion of stomach contents into mouth or nose.
- Rumen.* The paunch, or first stomach.
- Ruminants.* Cud-chewing animals.
- Sagittate.* Arrow-shaped.
- Salivation.* Excessive production of saliva.
- Sclerotium.* The wintering stage of Ergot, the hardened mass replacing the grain of the affected grass.
- Screenings.* Materials screened from grain or seed.
- Sepal.* One of the segments of the calyx.
- Serrate.* Toothed like a saw.
- Sessile.* Not stalked.
- Serum.* The thin fluid which separates from blood when it clots.
- Silica.* Silicon dioxide, the substance of which quartz sand is composed.
- Sinapism.* A mustard-plaster.
- Sinuate.* Wavy.
- Spadix.* A spike with a fleshy axis.
- Spathe.* The bract associated with the spadix.
- Species.* A group of plants or animals so nearly alike as to show only individual differences.
- Sphacelia.* The stage of Ergot where summer spores are produced.
- Spike.* A flower cluster with sessile blossoms arranged along a stalk, the youngest at the tip.
- Spikelet.* A secondary spike.
- Sporangium.* A spore-case.
- Sporangiophore.* A structure bearing sporangia.
- Spore.* A simple reproductive body usually composed of one cell.
- Stamen.* The pollen-bearing organ of a flower.
- Staminate.* Pertaining to stamens.
- Sterile.* Producing no fruit.
- Stipules.* Bracts at the base of a leaf.

Striate. Marked with small parallel lines or channels.

Style. The part of the pistil which joins the stigma to the ovary.

Subcutaneous. Under the skin.

Symbiotically. In partnership.

Tendon. A strand of white, fibrous tissue attaching, e.g., muscle to bone.

Toxic. Poisonous.

Toxin. A poisonous substance produced in diseased or decaying tissues.

Umbel. A flat-topped flower cluster with the flower stalks all coming from one point.

Vagus. The tenth cranial nerve.

Venation. The system of veins.

Vertigo. Dizziness or giddiness.

Volatile. Evaporating under ordinary conditions.

Vomition. Vomiting.

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